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An Annotated Bibliography of the Spotted Cutworm

Amathes c-nigrum (Linnaeus)

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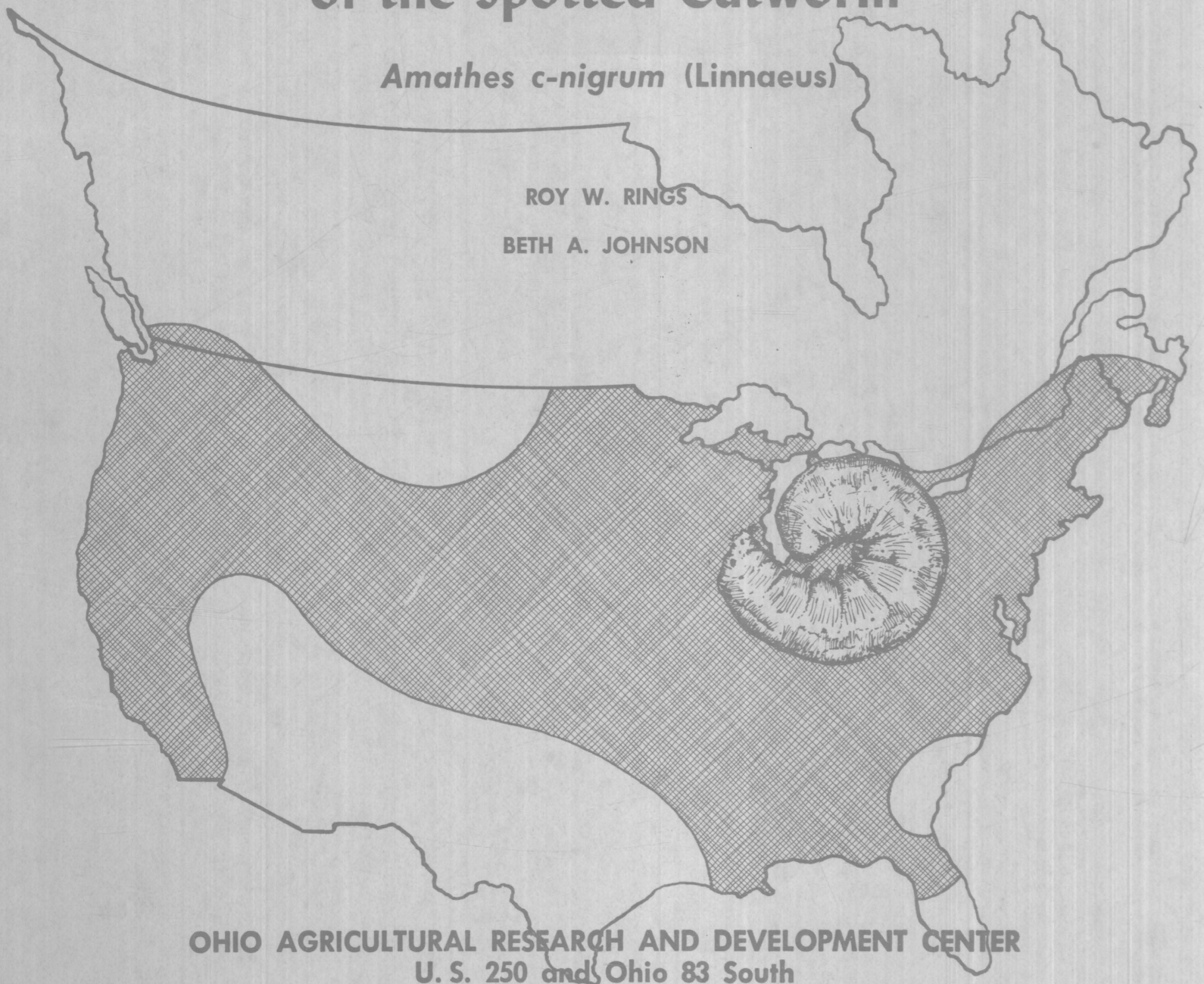

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AN ANNOTATED BIBLIOGRAPHY OF THE SPOTTED CUTWORM, Amathes c-nigrum (Linnaeus)[1]

Roy W. Rings[2] and Beth A. Johnson[3]

Introduction

The purpose of this research circular is to consolidate the abstracted literature on the spotted cutworm, *Amathes c-nigrum* (Linnaeus). This publication brings together research and extension information on developmental biology, ecology, host range, habits, geographical and seasonal distribution, and control for pest management purposes. It is not intended for taxonomic studies since most faunal lists, museum lists, and checklists cannot be abstracted for the literature retrieval of a single species.

This cutworm was originally described by Linnaeus in 1758 as *Noctua c-nigrum*. Since then the specific name has been constant but the generic name has undergone many changes such as *Segetia, Lytaea, Megasema, Rhyacia, Graphiphora, Diarsia,* and *Agrotis*.

The spotted cutworm ranges throughout the United States and southern Canada. It occurs in many European countries as well as in China and Russia.

This cutworm is a bivoltine species and hibernates as a partially grown larva. The egg, six larval instars, pupa, and moth are described by Crumb (1929). The moth is also described by Forbes (1954) and is illustrated in color by Holland (1934) and Rockburne *et al.* (1976).

The species is mentioned as a pest, sometimes of considerable proportions, in the literature on economic entomology. The first outbreaks of spotted cutworms were mentioned by Caesar in 1923 in Ontario. Franklin (1928) reported a similar outbreak the same year (1923) in Massachusetts where 200 acres of cranberries were destroyed. At least $100,000 damage was caused in the 1943 outbreak in the Matanuska area of Alaska. The principal species involved were the spotted cutworm and the red-backed cutworm, but at least three other species of cutworms were involved. The spotted cutworm is apparently of greater economic importance in the northern portions of North America.

In addition to cranberries, the following cultivated crops have been recorded as hosts of the spotted cutworm: alfalfa, apple, barley, beans, beets, blueberry, cabbage, carrot, cauliflower, celery, cherry, citrus, clover, corn, cotton, currant,

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flax, gooseberry, grape, hay, mangel, oats, pea, peach, pear, raspberry, rhubarb, rose, strawberry, sugar beet, sunflower, timothy, tobacco, tomato, turnip, vetch, and wheat. Many species of flowering annuals and perennials as well as wild plants also are fed upon by this species.

The bibliographical information was obtained by a search of the abstracting journals in The Ohio State University and the Ohio Agricultural Research and Development Center Libraries for the years 1864 to 1976. Photocopies or microfilms of material unavailable at these two libraries were obtained from the National Agricultural Library or from other university libraries.

The authors have established a current awareness profile on the spotted cutworm in cooperation with the Mechanized Information Center of The Ohio State University Libraries. This computerized system of retrieval will aid in keeping this bibliographical information current.

Entries are listed alphabetically by author in cases where the publication is anonymous or more likely to be identified with the governmental agency under which it was published. The abbreviations in the citations follow the American standard for periodical title abbreviations which was published in Biological Abstracts, 45(13):4347-4361. All references in this publication deal with *Amathes c-nigrum* Linnaeus; however, the scientific name used in the original article is also used in the annotation so there is no question as to the species being cited. The numbers in parentheses following the annotation represent the page numbers which include information on the spotted cutworm if they are different from the citation page numbers.

Bibliography

Aczel, M. 1941. *Agrotis c-nigrum* L. as a pest. Novenyegeszseguyi Evkonyv. 1 (1937-40):134-136.
The developmental biology and seasonal distribution of the spotted cutworm is discussed. At Budapest, Hungary, *A. c-nigrum* has two generations each year as does *Agrotis segetum*. This is a scientific note printed in both Hungarian and German. (Translated from German.) (135-136)

Anderson, D. M. 1975. Common names of insects. Entomol. Soc. Amer., Spec. Pub. 75-1:1-37.
The approved common name of *Amathes c-nigrum* in the United States is spotted cutworm. (14)

Anonymous. 1890. Proceedings of the entomological club of the American Association for the Advancement of Science. Can. Entomol. 22(2):213-236.
"Prof. Cook reported having bred *Agrotis c-nigrum* through all its stages upon black currant, the eggs having been laid in a cluster upon leaves of that plant on 1st of June - the perfect insect appearing on the 1st of August." (219)

Averin, V. G. 1915. Review of the pests noticed in the government of Charkov during 1913. Zemstvo (Charkov):10-65. 95 pp.
Agrotis c-nigrum caused damage to beets and cabbages in the Russian Ukraine.

Barrett, J. R., Jr., F. W. Harwood, and H. O. Deay. 1972. Functional association of light trap catches to emission of blacklight fluorescent lamps. Environ. Entomol. 1(3):285-290.
The relationship of light trap catches to the emission of single 4, 8, 15, 20, and 40-W blacklight fluorescent lamps was developed by using a catch index based on the number of individuals captured and the frequency of capture (including *Amathes c-nigrum*).

Beck, S. D. 1968. Insect photoperiodism. Academic Press, New York and London. 288 pp.
"*Agrotis c-nigrum* is listed in table VIII as an example of larval and nymphal diapause in which photo-periodic control (Induction or Termination) has been demonstrated or reasonably inferred." (190)

Belski, B. I. 1924. List of pests of medicinal plants from observations made in the environs of Kiev during 1919-1922. Trans. 4th All Russian Entomol. Phytopath. Meet., Moscow, 8-14 Dec., 1922:158-170.
Agrotis c-nigrum was found feeding on *Atropa belladonna* in Russia. (163)

Benoit, P. *et al.* 1976. French names of insects in Canada with corresponding Latin and English names. 4th Ed. Quebec. Agr. Pub. QA38-R4-30:1-214.
Amathes c-nigrum is known in French-speaking Canada as ver-gris tacheté (m.) and in English-speaking areas as the spotted cutworm. (26)

Beutenmüller, W. 1901. Descriptive catalogue of the Noctuidae found within 50 miles of New York City. Amer. Mus. Nat. Hist., Bull. 14(10):229-312.
The moth, caterpillar, and food plants of the spotted cutworm are described in this faunal list. (274-275)

Bonnemaison, L. 1969. Sterilising action of tepa and DMSO on various insects. Phytiat. Phytopharm. 17(2):105-117.

At a dosage of 4 mg/cm^2 and a contact of 30 minutes at 20° C, *Amathes c-nigrum* moths were sterilized with tepa in 24 hours. (Translated from French.) (105)

Boursin, C. 1963. The "Noctuidae" spp. (Agrotinae in the usual sense) from Dr. Hone's collections in China (Contribution to Chinese fauna). V. The *Amathes* complex. Forsch. Ber. Landes Nordrheinwest Falen. 1170:9-65.
Two synonyms listed in this article are *deraiota* Hps. and *praetermissa* Warr. *Amathes c-nigrum* was collected in the following Chinese localities: Tsinling, Shansi and Chekiang. (32)

Breniere, J. 1959. Service de recherches appliquees a la protection des vegetaux. Inst. Res. Agron. Madagascar, Bull. 3:1-140.
The author discusses the occurrence of tobacco cutworms in Europe, U.S.A., and Madagascar. In the United States, the principal species of cutworms are *Agrotis ipsilon*, two species of *Feltia, Peridroma margaritosa, Euxoa messoria,* and *Amathes c-nigrum.* These species are all economic pests of tobacco. (Translated from French.) (131)

Briolini, G. and G. Celli. 1970. Results of the captures of Lepidoptera performed for a period of 3 years by a Pennsylvania-type light trap. Boll. Est. Entomol. Univ. Studi. Bologna, 29:61-80. (In Italian.)
For obtaining numerical data about the populations of some insects feeding on apple trees, the authors kept a Pennsylvania-type light trap working for 3 years in an orchard near Ferrara, Italy. This note reports the results of the captures of Lepidoptera and brief considerations on some of the more interesting species, even if for their development they were not dependent upon apple trees. Among them: *Amathes c-nigrum* L., *Luperina dumerilii* Dup., *Euxoa temera* Hb. (Noctuidae); *Spilosama menthastri* Esp. and *Phragmatobia fuliginosa* L. (Arctiidae); *Udea ferrugalis* Hb. (Pyraustidae); *Simiothisa clathrata* L. and *Ascotis selenaria* Schiff. (Geometridae); *Philosamia cynthia* Drury (Saturniidae). For all the species, the percent number of individuals captured and their flight periods are given for each year. (79)

Brower, A. E. 1974. A list of the lepidoptera of Maine--Part I. The macrolepidoptera. Life Sci. Agr. Exp. Sta., Univ. Maine at Orono., Tech. Bull. 66:1-136.
"1511 *c-nigrum* Linnaeus, Spotted Cutworm 49 localities, 14 June-12 November, 1011 ♂; 18 June-17 November, 373 ♀." (40)

Buresch, I. 1914. Notes on nocturnal Lepidoptera of Bulgaria. Mem. Bulg. Nat. Soc. Sophia 6:39-98. [RAE 9:496-497 (1921).]
Agrotis c-nigrum is a pest in pastures in Bulgaria.

Buresch, I. 1914. The nocturnal Lepidoptera of Bulgaria with special reference to the harmful species. Mem. Bulg. Nat. Soc. Sophia. 7:9-100. [RAE 9:497-498 (1921).]
Agrotis c-nigrum L. is one of the common noctuids in Bulgaria.

Byers, J. R. and E. F. Bond. 1971. Surface specializations of the hindgut cuticle of lepidopterous larvae. Can. J. Zool. 49(6):867-876.
Light microscopy and scanning electron microscopy were employed to study the internal surface specializations of the hindgut cuticle of *Amathes c-nigrum* L. Four distinct types of spines were found, three of which have clearly attributable roles in alimentary function. (867)

Caesar, L. and W. A. Ross. 1923. Insects of the season in Ontario. Fifty-third Annu. Rep. Entomol. Soc. Ont. 1922, pp. 33-39.
"Spotted Cutworm (*Agrotis c. nigrum*). This cutworm was much more numerous than usual, and during the latter half of July in several localities, especially in Norfolk, Lambton, Peel, and Lennox and Addington counties, there were outbreaks of considerable importance. The newspapers erroneously referred to these as 'Army Worm Outbreaks.' The outbreaks were not unexpected, because in Norfolk on April 26 the senior writer saw fields in which the early brood of this same cutworm was abundant. At this date some of the larvae were almost full-grown, and others only half-grown, the average being about 1 inch long." (37)

Caesar, L. 1927. Insects attacking vegetables. Ont. Dep. Agr. Bull. 325:1-63.
Types of injury, life history, and control of *Agrotis c-nigrum* are given. (6-8)

The Canadian Agricultural Insect Pest Review

This publication aims to present, in manuscript form, a periodical statement on current insect pest conditions. It presents data governing the seasonal appearance, the effects of winter, degrees of parasitism, notes on distribution, and abundance of insect pests. It has been published by the Canada Department of Agriculture, Research Branch--Scientific Information Section, Ottawa, Ontario, from 1923 to present. From 1923 to 1967 this publication was known as the Canadian Insect Pest Review.

1923. Can. Insect Pest Rev. 1.
"The Spotted Cutworm *Agrotis c-nigrum* Linn., has done more injury on cranberry bogs of Massachusetts this year than in any previous year." (55)

1934. Can. Insect Pest Rev. 12.
"The spotted cutworm, *Agrotis c-nigrum* L., caused heavy loss to celery at London, Ont., by feeding on the heart of the plants." (128)

1935. Can. Insect Pest Rev. 13.
"An unusual outbreak of cutworms, probably the spotted cutworm, *Agrotis c-nigrum* L., and other species, has occurred through the southern part of western Ontario. The cutworms are migrating from grain, clover, pea, and alfalfa fields and infesting the nearest crop. Many sugarbeet fields have been slightly damaged, and one 8-acre field of sweet clover has been completely stripped of foliage. Prompt application of poisoned bran bait prevented considerable damage. The first record of damage was received on July 23. (G. M. Stirrett, July 25)... Practically all sweet clover fields left for seed in Middlesex and Elgin counties, Ont., are a complete loss due to infestations of the spotted cutworm, *A. c-nigrum* L. Furrows and post holes, with others spraying, have saved various crops. This species is in general outbreak form. The infestation at Lambeth may be controlled by fungus." (166)

1936. Can. Insect Pest. Rev. 14.
"In Ontario, where complaints of damage were numerous, a severe outbreak of the spotted cutworm, *Agrotis c-nigrum* L., developed throughout the southern areas and effected serious losses to root crops, corn, beans, alfalfa, and grains." (3) In Ontario "in the early part of the season (May and June) an unusually large number of complaints of cutworm injury was received from many parts of the province. Most of the damage was in gardens in villages, towns, and cities. Later in July and early August, cutworms again became abundant and injured tomatoes, corn, sweet clover, celery, and some other plants. The most common

species at this period was the spotted cutworm, *Agrotis c-nigrum.*" (28) "An unusual and spectacular outbreak of the spotted cutworm, *Agrotis c-nigrum* L., was experienced during the season. The outbreak reminded one of an army worm outbreak; indeed many farmers and others at first were under the impression that it was this insect as the larvae were similar in habits. The outbreak extended over most of southern Ontario from east to west. The insect was particularly numerous in Elgin, Kent, Lambton, and certain portions of Essex counties. Sugarbeets and white clover were the crops damaged to the greatest extent. Other crops damaged were corn, beans, alfalfa, and grains. The losses entailed were great and amounted to many thousands of dollars of damaged crops and in the extra labor of control measures. Prompt applications of our control recommendations saved hundreds of dollars worth of sugar-beet crops." (48)

1948. Can. Insect Pest Rev. 26.
"Seventh-instar larvae were found attacking tobacco seedlings in greenhouses near Simcoe and Langton, Norfolk County (Ontario). The injury was light but important. This is probably the first record of this cutworm injuring tobacco seedlings in greenhouses." (132)

1949. Can. Insect Pest. Rev. 27.
Graphiphora c-nigrum was present in Ontario but caused only minor injury to tobacco. (64)

1951. Can. Insect Pest Rev. 29.
"Nearly mature larvae of the spotted cutworm, *Graphiphora c-nigrum* L., are causing light to moderate damage to beets and peas throughout the Kentville district" (Nova Scotia). (119) "For the second consecutive year, cutworms were unusually numerous in Nova Scotia and many garden crops suffered severe damage. During May, the black and the spotted cutworms were moderately abundant in Kings County." (271)

1952. Can. Insect Pest Rev. 30.
"During May, the black cutworm, *Agrotis ypsilon* (Rott.), and the spotted cutworm, *Graphiphora c-nigrum* (L), were moderately abundant in Kings County" (Nova Scotia). (101)

1953. Can. Insect Pest Rev. 31.
"Blueberry cutworms in Charlotte County (New Brunswick) remained at approximately the same density with minor fluctuations of some species. However, there were five species collected this year that had not been taken in previous years; these were *Eurois astricta* Morr., *Graphiphora c-nigrum* (L.), *Lacinipolia lorea* Gn., *Lacinipolia lustralis* Grt., and *Syngrapha octoscripta* Grt." (100) Severe infestations of the spotted cutworm, *Graphiphora c-nigrum* L., caused considerable injury to a variety of plants in the Rougemont district, Quebec. "Heavy parasitism, ranging up to 75 percent, by dipterous and hymenopterous parasites was observed." (253) The w-marked cutworm and the spotted cutworm were reported from Rougemont, Quebec, where they damaged up to 50 percent of windfall apples in some orchards. (326)

1954. Can. Insect Pest Rev. 32.
"W-marked cutworm, *Spaelotis clandestina* (Harr.), and spotted cutworm, *Graphiphora c-nigrum* (L.), had a local importance and were responsible for damaging up to 50 percent of windfall apples in some orchards at Rougemont, Quebec." (95)

1957. Can. Insect Pest Rev. 35.
The spotted cutworm was commonly found with the armyworm in Ontario. (301)

1958. Can. Insect Pest Rev. 36.
In Ontario "it was of interest to note that minor infestations of the variegated cutworm, *Peridroma margaritosa* (Haw.), and the spotted cutworm, *Amathes c-nigrum* (L.), occurred in conjunction with the armyworms in many infested fields." (65) Moths of the spotted cutworm, *Amathes c-nigrum* L., and of the armyworm have been very numerous in Kent County (Ontario), but no reports of injury to plants have been received to date." (192)

1959. Can. Insect Pest Rev. 37.
On the page opposite page 124, a map shows the known distribution of the spotted cutworm, *Amathes c-nigrum* L., in Canada. *Amathes c-nigrum* was one of the species of cutworms collected in light traps in Chatham, Ontario. (237) The spotted cutworm, *Amathes c-nigrum*, was one of the cutworm species found to be feeding on tobacco in Ontario. (241)

1960. Can. Insect Pest Rev. 38.
In British Columbia "throughout April and early May leaf buds and small leaves were damaged by the spotted cutworm, *Amathes c-nigrum* L., in some orchards in the southern Okanagan Valley in the districts of Oliver and Osoyoos. Damage was not serious except on small trees where opening buds were eaten off." (143) *Amathes c-nigrum* was taken at light traps at Chatham, Ontario, from April to July 15. (170) "The spotted cutworm was identified for the first time as having been the cause in some recent years of damage in some orchards, mainly to the buds of small trees in the southern Okanagan, British Columbia." (219) *Amathes c-nigrum* was taken at light traps in Chatham, Ontario, from August 15 to Sept. 15. (223) *Amathes c-nigrum* was taken at light traps in Chatham Ontario, from Sept. 16 to Oct. 15. (224) In British Columbia "in some orchards the spotted cutworm caused slight damage to buds and leaves on young apple, cherry, and peach." (283)

1961. Can. Insect Pest Rev. 39.
In British Columbia "in some orchards slight damage was done during late April and early May to buds and leaves of young apple, cherry, and peach trees by the spotted cutworm, *Amathes c-nigrum* (L.)." (9) *Amathes c-nigrum* was taken at light traps in Chatham, Ontario, from July to September. (209) *Amathes c-nigrum* was taken at light traps in Chatham, Ontario, from September to October. (210)

1962. Can. Insect Pest Rev. 40.
Amathes c-nigrum was taken at light traps at Chatham and Delhi, Ontario, from April to June. (36-37) *Amathes c-nigrum* was taken at light traps at Chatham, Ontario, from June 16 to July 15. A local outbreak of the spotted cutworm, *Amathes c-nigrum* L., occurred in July on weeds in a field of spring grain along the Rideau River near Kemptville, Ontario. (59) *Amathes c-nigrum* was taken at light traps at Chatham and Fairground, Ontario. (92-93) Minor pests which have shown an increase in importance were *Pseuderentera mali* Freeman, the two spotted mite, the tarnished plant bug, and the spotted cutworm, the last feeding on windfall apples." (104) "At Kemptville in eastern Ontario, the spotted cutworm occurred in a localized outbreak in oats. In southwestern Quebec the spotted cutworm damaged up to 50 percent of fallen apples at St. Hilaire in mid-August." (160) In Ontario "in late July and early August, a localized outbreak of the spotted cutworm occurred in oat fields near Kemptville. There were four to five larvae per square foot in a 5-acre field and an adjacent 10-acre field. Damage to the oats was negligible, the larvae feeding mainly on weeds and alfalfa and red clover seedlings in the oat fields. The insect also fed on rhubarb and tomato plants growing near the oats." (238) "In mid-August,

this cutworm was common in a few apple orchards at St. Hilaire, Quebec, and was responsible for damaging up to 50 percent of windfall apples. However, during the last week of August the infestation rapidly decreased as larvae entered the soil to pupate." (241)

1963. Can. Insect Pest Rev. 41.
"In Ontario...the spotted cutworm, *Amathes c-nigrum* (L.), not a pest of tobacco in recent years, caused some damage." (90) "A severe infestation of the spotted cutworm, *Amathes c-nigrum* (L.), damaged a field of birdsfoot trefoil in Kent County, Ontario." (92) "A very heavy infestation was found attacking birdsfoot trefoil in Chatham Tp., Kent County, Ontario." (218) "Larvae of this species were not observed in oat fields in the Ottawa area. In 1962 a localized outbreak of this species had occurred in the Kemptville area of Ontario." (225)

1964. Can. Insect Pest Rev. 42.
"Note sur le vers gris tachete', *Amathes c-nigrum* (L.) (Lepidoptères:Noctuidae), s'attaquant aux pommes sur le sol dans le Québec." (118)

1972. Can. Insect Pest Rev. 50.
"In southwestern Quebec, many growers complained of cutworm damage, especially to onions, but also to carrots, tomatoes, and cucumbers. Species concerned included *E. ochrogaster, E. messoria, E. tessellata* (Harris), *Agrotis ipsilon* Hufnagel, and *Amathes c-nigrum* (L.)." (18)

1973. Can. Insect Pest Rev. 51.
In Quebec "the spotted cutworm, *Amathes c-nigrum* (L.), and the redbacked cutworm, *Euxoa ochrogaster* (Guen.), and the variegated cutworm, *Peridroma saucia* (Hübn.), are the three predominant species in the organic soil area. Onion is the main crop injured." (20)

Chamberlin, J. C. 1944. Entomological work in Alaska. Proc. Entomol. Soc. Wash., 46(4):100-104.
"Cutworm injury in Alaska is much less extensive although locally, as in Matanuska in 1943, much more serious than root maggot injury. Cutworms caused some injury to crops in the Tanana Valley in 1939 and have done extensive damage in the Matanuska Valley as far back as 1928. Years of most serious damage in Matanuska have been 1928, 1935, 1942, and 1943. At least $100,000 damage was done in the 1943 outbreak. It is probable that several cutworm species were actually involved in the 1943 outbreak, including the redbacked cutworm (*Euxoa ochrogaster* Gn.) and the spotted cutworm (*Amathes c-nigrum* (L.)). At least three other cutworm species with past histories of economic damage also were found (the glassy cutworm, the w-marked cutworm, and the black army cutworm)." (103)

Chamberlin, F. S. and N. Allen. 1957. Tobacco cutworms. How to control them. U.S. Dep. Agr. Leaflet 417:1-8.
Life history and control measures for various cutworms which attack tobacco are discussed. Included are variegated cutworm, black cutworm, yellow-striped armyworm, clay-backed cutworm, spotted cutworm, dingy cutworm, and granulate cutworm. "The spotted cutworm has a row of wedge-shaped black marks down each side of the back. It may have 2 or 3 generations a year. It is a very destructive northern species, but is scarce in the south." (4)

Chittenden, F. H. 1903. A brief account of the principal insect enemies of the sugar beet. U. S. Dep. Agr., Div. Entomol. Bull. 43:1-71.
Noctua c-nigrum Linn. "This is one of our commonest and most destructive species, and is commonly found on beets. It resembles the variegated cutworm in being cosmopolitan, nearly omnivorous, a climbing species, and in migrating in numbers like the army worms. ... The principal crops which it has been known to injure include, besides beets, corn, and other cereals, cabbage, cauliflower, turnip, pea, carrot, tomato, celery, rhubarb, currant, gooseberry, clover, violets, and some ornamental plants. It has been noticed attacking grasses and oats, but does not appear to resort to these plants when more choice food is at hand. (31-32)

Chittenden, F. H. 1907. Insects injurious to vegetables. Orange Judd Co., London. 262 pp.
"The corn cutworm (*Noctua c-nigrum* Linn.), better known as the spotted cutworm, is one of our commonest and most destructive species, and resembles the variegated cutworm treated on pages 53 and 54, being cosmopolitan, nearly omnivorous, a climbing species, and traveling in armies like the army worm. The cutworm (fig. 134,b) is pale brown or gray, sometimes whitish, with green or olive tints and measures fully about an inch and a half. The moth has brown forewings, tinged with reddish or purplish, and marked as figured (fig. 134, a). In addition to corn and cereals, this species affects cabbage, turnip, pea, carrot, tomato, celery, rhubarb, and other vegetables. Cutworm remedies are discussed on page 54." (210-211)

Cook, W. C. 1920. Cutworms and armyworms. Office State Entomol., Univ. Farm, St. Paul, Minn., Circ. 52:1-8.
This publication contains simplified keys to identify common cutworms and suggestions for control. The spotted cutworm may be recognized by the triangular black markings on the back.

Cook, W. C. 1921. Studies on the flight of nocturnal Lepidoptera. 18th Rep. Minn. State Entomol., Agr. Exp. Sta., pp. 43-56.
The seasonal and meteorological relations of adult *Agrotis* species were discussed. Humidity was the most important factor studied. *Agrotis c-nigrum* was two-brooded in Minnesota.

Cook, W. C. 1934. Cutworms and armyworms. Minn. Agr. Exp. Sta. Circ. 48:1-8.
This publication is a reprint of Cook (1920).

Crosby, C. R. and M. D. Leonard. 1918. Manual of vegetable garden insects. The Macmillan Co., New York. 391 pp.
The larva and adult spotted cutworm are described and its food plants are discussed. (262-263)

Crumb, S. E. 1915. A key to the cutworms affecting tobacco. J. Econ. Entomol. 8:392-396.
This is a key to the cutworms attacking tobacco in the United States, including the spotted cutworm.

Crumb, S. E. 1926. Tobacco cutworms and their control. U. S. Dep. Agr., Farm. Bull. 1494:1-14.
"The spotted cutworm (fig. 8) is a very destructive northern species, but is scarce in Tennessee and probably does not occur much farther south. The winter is passed as a larva or cutworm, and there are at least three generations dur-

ing the year in Tennessee. The period of destructiveness for cutworms of this species is over in Tennessee by the middle of April, but extends somewhat into May in Illinois. The main flight of the moths of the last broods--and it is these which infest land with the injurious spring brood of cutworms--begins early in August and extends at least through September. This cutworm has a row of wedge-shaped black marks down each side of the back and has no black marks on the sides." (7)

Crumb, S. E. 1927. The armyworms. Bull. Brooklyn Entomol. Soc., 22(1):1-306.
Mature larva, distribution, and food plants of the spotted cutworm (*Agrotis c-nigrum*) are discussed. (48)

Crumb, S. E. 1929. Tobacco cutworms. U. S. Dep. Agr., Tech. Bull. 88:1-179.
This is a very complete account of cutworms, including *Agrotis c-nigrum* (L.), which attack tobacco. It includes larval and pupal anatomy and keys to species for eggs, larvae, and pupae. Distribution, hosts, seasonal history, and description of stages are given for important species. Control measures include natural (such as pathogens and predators), chemical, and cultural.

Crumb, S. E. 1932. The more important climbing cutworms. Bull. Brooklyn Entomol. Soc., 27(2):73-100.
The mature larva, distribution, and food plants for *Agrotis c-nigrum* are described. (87-88)

Crumb, S. E. 1956. The larvae of the Phalaenidae. U. S. Dep. Agr., Tech. Bull. 1135:1-356.
Appearance, distribution, life history, and food habits of the spotted cutworm (*Graphiphora c-nigrum*) are described. (107)

Daele, E. Van and C. Pelerents. 1968. Four years of observations on the Noctuidae of the horticultural region of Ghent. Mededell. Rijksfack. Landbouwwetenschap. Ghent, 33(1):1-31.
In the horticultural region of Ghent, *Amathes c-nigrum* L. was captured 77 nights in 1962, 70 in 1963, 67 in 1964, and 64 in 1965. This moth was one of the dominant species and averaged 16 individuals per night. (Translated from French.)

Daele, E. Van and C. Pelerents. 1969. Summary of the observations effected over four years on the nocturnal Lepidoptera of the horticultural region of Ghent. Mededell. Rijksfak. Landbouwwetenschap. Ghent, 34(1):31-56.
In the horticultural regions of Ghent, nocturnal Lepidoptera were studied by collections from mercury-vapor and modified Robinson light traps. *Amathes c-nigrum* was collected as early as May 25, 1964, and as late as Oct. 12, 1963.

Danilevskii, A. S. 1961. Photoperiodism and seasonal development of insects. English translation 1965. Oliver and Boyd, Edinburgh and London. 345 pp.
"In the comparative investigation of photoperiodic reactions in our laboratory, we studied in greater or less detail about 90 species of insects and phytophagous mites. Including data from other authors, the total number of species studied in this connection is now about 130. A list of them, with a brief indication of their reactions, is given in the appendix. In spite of the unequal extent to which different orders have been studied, the data available enable us to make a fairly definite estimate of the distribution of photoperiodic adaptations in the various systematic and biological groups. Lepidoptera have received the most systematic and detailed study. *Agrotis c-nigrum* was included in this study." (37)

Davis, G. C. 1893. Celery insects. Mich. Agr. Exp. Sta., Bull. 102:23-52.
"The *c-nigrum* is usually known best as a corn cut-worm. It is also known to destroy cabbages and other garden plants. In 1890 it was reared here on the currant by Prof. Cook from eggs found June 26. There are two broods each year, the last one remaining over winter in the grub state." The moth and larva are figured. (47)

deJoannis, J. 1928. Lépidoptères hétéroceres du Tonkin. Ann. Entomol. Soc. France, 97:241-368.
"*A. c-nigrum* L., Syst. Nat., ed. 10, p. 516 (1758) (*Noctua*); Hb., Samml. Eur. Schm., Noct., pl. 24, fig. 111; Hmpsn., Faun. Br. Ind., Moths, II, p. 188; Cat., IV, p. 389; Warr., *in* Seitz, III, p. 43, pl. 9, g: XI; p. 55. Hoang su phi (Robert)." (289)

Dirks, C. O. 1937. Biological studies of Maine moths by light trap methods. Maine Agr. Exp. Sta., Bull. 389:1-162.
The geographical distribution, abundance, and host range of *Agrotis c-nigrum* are described. (79)

Dobrovliansky, V. V. 1915. Report of the entomological section. Report on the work of the Kiev Station for the control of pests and plants of the South Russian Agricultural Syndicate for 1914. Husbandry (Kiev) nos. 18-24, 27-28:532-539, 564-568, 594-599, 621-626, 655-660, 697-702 and 763-766. [RAE 3:638-641 (1915).]
Agrotis c-nigrum was one of the noctuidae caught in traps with molasses at Kiev, Russia.

Dochkova, B. 1971. Injurious noctuids on sugar-beet in northern Bulgaria. Rast. Zash., 19(12):11-13.
This article is in Bulgarian but has no English summary. Presumably it describes the spotted cutworm as a pest of sugar beets in northern Bulgaria. (11)

Draudt, M. 1924. *Agrotis*. The macrolepidoptera of the world. 7:56.
"*A. c-nigrum* L. (9e) has been dealt with at large in the palearctic and Indo-Australian parts. This well-known species occurs in America from Canada down to Mexico."

Druzheliubova, T. S. 1973. Use of environmental temperatures in forecasting development of *Agrotis* species. (*Agrotis segetum, Agrotis c-nigrum, Agrotis exclamationis.*) Tr. Vses. Inst. Zashch. Rast., 38:89-96.
"Some differences have been established in temperature and light responses between geographical and seasonal populations of *Agrotis segetum* Schiff., *Agrotis exclamationis* L., *Agrotis ypsilon* Rott., and *Graphiphora c-nigrum*. When agroclimatic factors were applied to forecast *Agrotis segetum* development time and population dynamics in different habitat areas, a correction factor proved to be necessary." (96)

Edwards, H. 1889. Bibliographical catalogue of the described transformations of North America Lepidoptera. Bull. U. S. Nat. Mus. 35:1-147.
There are eight references listed for *Agrotis c-nigrum*. Eight of these contain descriptions of the larva and one a description of the pupa. (83)

Eguchi, M. 1926. Noctuidae infesting sugar-beet. Korea Agr. Exp. Sta., Bull. 3:257-263, Suigen, Korea. (In Japanese.)
Agrotis c-nigrum is recorded as a pest of sugar beets in Korea.

Fedorov, S. 1928. Vine pests in the Crimea according to observations made in 1926-27, and their control. Vest. Vinodel. Ukrain. 29(6):331-335.
The spotted cutworm, *Agrotis (Rhyacia) c-nigrum* L., was an unusual pest of vines and occurred along the entire southern coast of the Crimea.

Ferguson, D. C. 1954. The lepidoptera of Nova Scotia. Proc. Nova Scotian Inst. Sci., 23(3):161-375.
"1511 *G. c-nigrum* Linn. Widely distributed and common especially at bait. June 12 - Sept. 22. Most plentiful in late summer and fall." (228)

Ficht, G. A. 1940. Notes on Indiana Noctuidae. Proc. Indiana Acad. Sci., 49:243-253
"*A. c-nigrum* L. (1424). Spotted cutworm. Numerous from May to October. Dekalb Co., May 18 - Oct. 19; Greene Co., emerged May 20 (J.J.D.); Huntington Co., emerged May 28 (J.J.D.); Starke Co., emerged Aug. 15 - Sept. 11 (J.J.D.); Steuben Co., June 11, 12, 16, 24 (G.R.); Tippecanoe Co., emerged July 12 - Sept. 7 (J.J.D.); Warren Co., emerged July 19 (J.J.D.)." (245)

Filip'ev, I. N. 1929. Annual report of the division of applied entomology. Ann. Inst. Exp. Agron., 7(1):94-106.
Title only. (In Russian.)

Forbes, S. A. 1890. Notes on cutworms. 16th Rep. Trans. Dep. Agr. Ill., pp. 84-97.
Agrotis c-nigrum seems to be two-brooded, as already surmised by Coquillet and French, imagos of the first generation appearing in May and early in June, and those of the second late in July and in August. The fall generation does little, if any, injury, and the spring generation may ordinarily be expected to cease its mischief by about the first of May. (86-87)

Forbes, S. A. 1904. The more important insect injuries to Indian corn. Univ. Ill. Agr. Exp. Sta., Bull. 95:331-399.
Appearance, habits, and distribution of the spotted cutworm are described briefly. The larva and moth are figured. (355-356)

Forbes, S. A. 1905. Noxious and beneficial insects. Twenty-third Ill. State Entomol. Rep., pp. 1-273.
This report is identical to the previous citation.

Forbes, W. T. M. 1923. Trap-lantern record at Ithaca, New York (Lepidoptera). Can. Entomol., 55 (7-8): 151-158 and 175-184.
"1424 *Agrotis c-nigrum* Linnaeus. 64: three flights, with climax about July 8, August 18, and September 18. Only two broods are to be expected, and the meaning of the double flight in the fall is not clear. The few specimens in 1919 almost all belonged to the first brood." (153)

Forbes, W. T. M. 1923. The lepidoptera of New York and neighboring states. Primitive forms, Microlepidoptera: Pyraloids, Bombyces. Cornell Univ. Agr. Exp. Sta., Mem. 68:1-729.
Forbes considered *Noctua c-nigrum* larvae to be dimorphic. One form is generally brown in color while the other (summer generation) is green. (13)

Forbes, W. T. M. 1954. Lepidoptera of New York and neighboring states. Noctuidae. Part III. Cornell Univ. Agr. Exp. Sta., Mem. 329:1-433.
This publication presents keys to the subfamilies, genera, and species of noctuid moths. A brief description is given of the larva and geographical distribution. A complete description of the adult stage is presented. (59-60)

Franklin, H. J. and D. S. Lacroix. 1924. The spotted cutworm, *Agrotis c-nigrum* (L.), a cranberry pest. J. Econ. Entomol., 17:406-408.
"*Agrotis c-nigrum* has been known to injure limited cranberry areas occasionally in previous years, the outbreak in every case observed being on a bog on which the winter water had been held late, but no cranberry grower recalls a former instance of any such extensive injury as occurred in 1923." (408)

Franklin, H. J. 1925. Cranberry insect investigations. Annu. Rep. Cape Cod Cranberry Grow. Assoc., 36 (1923-24):4-7.
During 1923 considerable damage was done by the spotted cutworm, *Agrotis c-nigrum*, but observations indicate that this pest only attacks cranberry bogs when the winter water is held later than May 20.

Franklin, H. J. 1928. Cape Cod cranberry insects. Mass. Agr. Exp. Sta. Bull. 239: 1-67.
The spotted cutworm has been known to injure occasionally small areas of bog on Cape Cod for over 12 years but has not been reported as a cranberry pest elsewhere. There was a marked outbreak in 1923, 200 acres or more of bog in various parts of the Cape being so infested as to lose most of the prospective crop, and a few of the worms and scattering marks of their work being found on most bogs. The distribution, food plants, types of injury, description, seasonal history, and treatment for the spotted cutworm are described.

Franklin, H. J. 1948. Cranberry insects in Massachusetts. Mass. Agr. Exp. Sta. Bull. 445:1-64.
The spotted cutworm was reported as a pest of cranberry. This report describes distribution, food plants, type of injury, physical description, seasonal history, and control measures. (23, 28-29). The cutworm damage on cranberry is illustrated. (30)

French, G. H. 1878. Moths--Lepidoptera. Ill. State Entomol. Annu. Rep. 7:79-106.
This report describes the characters, habits, ravages, and remedies for cutworms, including *Agrotis c-nigrum*. (89)

French, G. H. 1878. Lepidoptera. 7th Rep. State Entomol. Ill.:135-268.
The larva and moth of *Agrotis c-nigrum* are described. (202-204)

French, G. H. 1878. Insects injurious to the vegetable garden. Trans. Ill. State Hort. Soc., 11:179-204.
The appearance of the moth and larva of the spotted cutworm are described. (186-187)

Frost, S. W. 1955. Cutworms of Pennsylvania. Penn. Agr. Exp. Sta. Bull. 596:1-29.
Amathes c-nigrum is closely related to *Agrotis unicolor* and *Actebia fennica* in that all tend at times to climb trees or vines and to feed upon fruits or foliage. "The larva of the spotted cutworm is easy to recognize. It is brown or gray with a pair of oblique black spots on each of the abdominal segments, becoming very distinct on the last four segments, fig. 17." (20-21)

Fujimura, T. 1976. Mating behavior and sex attractant of spotted cutworm moth, *Amathes c-nigrum* L. (Lepidoptera-Noctuidae). Jap. J. Appl. Entomol. and Zool., 20(3):133.
"The mating behavior and sex attractant of the spotted cutworm moth, *Amathes c-nigrum* L., were investigated. Virgin females released sex pheromone at 5-8.5 hours after sunset, and mating response of unmated males occurred at 4.5-8.5 hours after sunset. The maximum peak of mating appeared just at midnight. Age

of moths was an important factor for their successful mating; the maximum mating rates were recorded with 2- to 3-day-old moths. The virgin female moth releasing sex pheromone did not halt at one position. Instead, she walked on the ground in long distance without vibrating her wings as in 'calling position'. An active male moth walked on the path of a female moth without performing his 'mating dance'. These behaviors were peculiar to *A. c-nigrum* L. With ten virgin females in a trap, the same number of unmated males were trapped per night in the field. Crude extracts of the abdominal tips of virgin females in methylene chloride also attracted males in the field. Synthetic *cis*-7-tetradecen-1-ol acetate attracted males in the field, but *trans*-isomer did not. Black light traps baited with virgin females or synthetic *cis*-7-tetradecen-1-ol acetate attracted and captured about twice as many males as the numbers caught by unbaited black light traps."

Gagnepain, C. 1973. Study of a noctuid population by means of light-traps. :716-727. [RAE 62:1203 (1974).]
"Noctuid populations in the valley of the Chevreuse in France were studied in 1965-68 by means of light-traps of the Jermy type. The possibilities of this method are described and discussed. A table is given showing the species caught each month throughout 1968, the total number of examples of each species for the year, and the relative importance of the catches. The significance of the sex ratio in the catches is discussed; the proportion of females was always lower than that in the field but was higher in summer than in spring. A particular study was made of catches of *Agrotis (Scotia) exclamationis* (L.), *Amathes c-nigrum* (L.), *Ochropleura plecta* (L)., *Noctua pronuba* (L.), and *Autographa gamma* (L.), including the relation between population levels of successive generations, the stability of maximum catch periods, and the effect of migration on the numbers of some of the species concerned."

Gasser, R. 1953. On a new insecticide with a wide range of effectiveness. Zeit. Naturforsch., 8b(5):225-232.
Diazinon showed a wide spectrum of insecticidal activity which included larvae of *Amathes c-nigrum*. (Translated from German.)

Gibson, A. 1912. Cutworms and armyworms. Can. Dep. Agr., Div. of Entomol. Bull. 3:1-29.
Appearance, habits, and life history of the spotted cutworm are described. (21-22)

Gibson, A. 1915. Cutworms and their control. Can. Dep. Agr., Entomol. Br. Bull. 10:1-31.
Identical to Gibson, A. 1912. (23-24)

Gibson, W. W. and J. L. Carrillo. 1959. Lista de insectos en la coleccion entomologica de la oficina de estudios especiales, S.A.G. Secretar. Agr. Ganad., Offic. Estud. Espec. Mex., Foll. Misc. 9:1-254.
In this Mexican museum list, the spotted cutworm is reported as "*Amathes* (=*Noctua*) *c-nigrum* (L.) Mass., E.U.A. 15-VI." (156)

Gillette, C. P. 1891. Notes and experiments with injurious insects and insecticides. Iowa Agr. Exp. Sta., Bull. 12:535-549.
The spotted cutworm, (*Agrotis c-nigrum*). "This is a common but not very abundant insect in Iowa. I have not bred the moths but have 12 dates of their capture running through 3 years. According to these captures the insect is double brooded. The moths of the first brood have been captured from May 23 to June

16 and of the second brood from August 25 to Oct. 1. The moths have been most abundant about June 10 and Sept. 20. Females examined on Oct. 1 had many mature eggs in their ovaries." (541)

Gokhelashvili, R. 1956. On the problem of the studying of cutworm moth bio-ecology. Trudy. Opyt. Stan. Plodovodstva Akad. Nauk, Gruz SSR, 1956(4):121-131. Title only. In Slavic with Russian summary.

Gossard, H. A. 1917. Cutworms. Their habits, characteristics, and means of control. Ohio Agr. Exp. Sta. Mon. Bull., 2(3):85-90.
"The spotted cutworm (*Noctua c-nigrum*) has two rows of triangular-shaped black spots, one on each side of the back, the narrowest angle of each triangle pointing headward. The general color is pale brown or ashy gray." (87)

Grote, A. R. 1872. On the Noctuidae of North America. 6th Annu. Rep. Peabody Acad. Sci., pp. 21-38.
The author has no doubt that *Agrotis c-nigrum* occurs in both Europe and America. (22).

Grote, A. R. 1874. I. List of the Noctuidae of North America. Bull. Buffalo Soc. Nat. Sci. 2:1-46.
The spotted cutworm is included in this faunal list as "*Agrotis c-nigrum* (Linn.) Guen., Noct. 1,328." (9)

Grote, A. R. 1875. Check list of the Noctuidae of America, North of Mexico. Beinecke & Zesch., Printers, Buffalo, N. Y. (1):1-28.
The spotted cutworm is included in this faunal list as *Agrotis c-nigrum* (L.).(5)

Grote, A. R. 1882. New checklist of North American moths. New York Entomol. Club. 73 pp.
The spotted cutworm is included in this checklist as *Agrotis c-nigrum* Linn. (24)

Guenée, A. 1852. Species Général des Lepidoptérés. Noctuelites. 1:328.
Noctua c-nigrum is common throughout Europe from June to August. It hibernates as a larva. (Translated from French.)

Hart, C. A. 1903. Synopsis of insect collections for distribution to Illinois high schools. Lepidoptera. (Butterflies and moths.) Ill. State Lab. Nat. Hist. 64 pp.
"112. *Noctua c-nigrum* Linn. Black- C Owlet. L., Spotted Cut-worm. F., garden vegetables and other low plants. H. as larva, soon pupating in earthen cell; I., late May and early June; 1., July; II., late July and Aug. For preventives, see No. 108. A broad, pale, V-shaped area on front margin, its apex in the roundspot, each side of which is an angular blackish mark. Comstock, 306. (Fig. 39.)" (29-30)

Hawkins, J. H. 1930. Tarsal claws of noctuid larvae. Ann. Entomol. Soc. Amer., 23:393-396.
The larval tarsal claw of *Agrotis c-nigrum* is figured. (394) A table of ratios of parts of tarsal claws is given on page 396.

Hinks, C. F. 1970. The neuroendocrine organs in adult Noctuidae. Can. J. Zool., 48(4):831-835.
This is a detailed study of the innervation of the neuroendocrine organs in eight species of Noctuidae which has revealed a previously undescribed network of nerves. The spotted cutworm was one of the species used. (831)

Hinz, R. 1973. Contributions to knowledge of the species of Ichneumoninae. I. (Hym., Ichneumonidae). Entomol. Nachr., 17(7-8):97-105.
Title only.

Hofmaster, R. N., R. L. Waterfield, and J. C. Boyd. 1967. Insecticides applied to the soil for control of eight species of insects on Irish potatoes in Virginia. J. Econ. Entomol., 60(5):1311-1318.
The black cutworm, the variegated cutworm, the granulate cutworm, and the spotted cutworm were all found feeding underground on potato tubers at Painter, Va. No information is given on chemical control of the spotted cutworm.

Holland, W. J. 1934. The moth book. A popular guide to a knowledge of the moths of North America. Dover Publications, Inc., N. Y. 479 pp.
"(3) *Noctua c-nigrum* Linnaeus, Plate XXII, Fig. 1, ♀. (The Blackletter Dart.) Universally distributed through the Appalachian Subregion and also occurring in Europe." (183) The moth is illustrated in color in plate 22.

Hudson, M. and P. Martel. 1973. Insects of market cultures in southwestern Quebec in 1972. Ann. Soc. Entomol. Que., 18(1):3-4.
The principal species of cutworms attacking truck crops in southwest Quèbec were *Amathes c-nigrum* (L.), *Agrotis ipsilon* (Hufn.), *Nephelodes minians* Guen., *Euxoa messoria* (Harr.), *Euxoa ochrogaster* (Guen.), and *Euxoa tesselata* (Harr.)

Ionescu, M., M. A. S. Alexandrescu, A. Ganescu, I. Borcau and D. M. Boiangiu. 1961. Contributii la studiul combaterii speciilor de buha semanaturilor. (*Agrotis*) daunatoare culturilor de porumb. Ann. Inst. Cent. Cercetari Agr., 19 (Ser. B): 445-451.
The bionomics of *Amathes c-nigrum, Agrotis ipsilon, Agrotis segetum, Agrotis exclamationis, Agrotis cuassa, Euxoa tritici,* and *Peridroma saucia* were studied at Bucharest, Romania. A BHC dust or aldrin incorporated into the soil gave the best control. (450)

Johansen, Carl. 1973. How to recognize cutworms, armyworms, loopers. Pac. NW. Coop. Ext. Pub. 130:1-31.
A spotted cutworm larva is illustrated. The distinguishing features, life history, and principal hosts are discussed. (10)

Jones, F. G. W. and M. Jones. 1964. Pests of field crops. St. Martins Press, New York. 406 pp.
Amathes c-nigrum is listed as a cutworm pest in England which may feed on many vegetables, sugar beet stecklings, and chrysanthemums. It is known in England as the setaceous Hebrew character. (101)

Kalshoven. L. G. E. 1951. De plagen van de cultuurgewassen in Indonesie. Lepidoptera, Vlinders.:567-573.
Amathes c-nigrum L. is widespread over North America, Europe, and Asia including Java. Eighteen references to the species are given. (572)

Kimball, C. P. 1965. The Lepidoptera of Florida, an annotated checklist. Div. Plant Ind., Fla. Dep. Agr. 863 pp.
"Graphiphora Ochsenheimer 1511 *G. c-nigrum* (Linnaeus) Syst. Nat. 10:516. 1758. I. Myrtle Grove: May 11, 1963, WJM. Quincy: Oct. 30, 1961, (Tappan), CPK. II. Gainesville: May 13, 1958, (Denmark), det. Franclemont, DPI. Larva a cutworm." (87)

Kind, T. V. 1968. The neurosecretory system of different geographical races of *Agrotis (amathes) c-nigrum* (Lepidoptera, Noctuidae) during active development and in diapause. Zool. Zhur., 47(10):1489-1497.
"Two races of *Agrotis c-nigrum* differing in the deepness of the diapause were investigated. The cyclic changes at moulting were recorded only for the L. group of neurosecretory cells (NSC). NSC do not exhibit the activity cycles at moulting of both active and resting larvae."

Klyuchko, Z. F. and M. K. Narzaeva. 1971. *Amathes c-nigrum* in the Ukraine. Zasch. Rast., 16(7):35-36.
The spotted cutworm is described as a pest in the Ukraine. The larva, moth and tip of pupal abdomen are illustrated. (35) (Translated from Russian.)

Knutson, H. 1944. Minnesota Phalaenidae (Noctuidae). The seasonal history and economic importance of the more common and destructive species. Univ. Minn. Agr. Exp. Sta., Tech. Bull. 165:1-28.
Museum specimens examined, collections, rearing data, reports of damage, seasonal history, and economic importance of *Graphiphora c-nigrum* are described. (32-33)

Kowalska, T. 1962. A method of rearing larvae of *Agrotis c-nigrum* L. and *A. exclamationis* L. (Lepidoptera, Noctuidae) in laboratory conditions. Biul. Inst. Ochr. Rósl. (14):35-42.
"Method of mass rearing of caterpillars *Agrotis c-nigrum* L. and *A. exclamationis* L. (Lepidoptera, Noctuidae) under laboratory conditions is described. The method proved to be satisfactory to receive caterpillars for biological studies as well as test insects for toxicological and microbiological experiments. Caterpillars of any instar can be freely received. Main advantage of this method is using of grass *Festuca ovina* L. on which females lay eggs instead of on filter paper; this allows to save many eggs which are frequently broken when removed from paper or cage walls." (42)

Kowalska, T. 1962. The nature of the annual biological cycles of the cutworms *Agrotis exclamationis* and *Amathes c-nigrum*. Biul. Inst. Ochr. Rósl., (17): 49-65. [RAE 51:474 (1963).]
"In the course of laboratory studies on populations of two cutworms *Euxoa exclamationis* L. and *Rhyacia c-nigrum* L. in the neighbourhood of Poznán gave following results. Cutworm *R. c-nigrum* has development continual and diapause is caused by low temperature. Small caterpillars overwinter which require additional feeding in spring before pupation. In Poland this species appears in two full generations. Biological cycle of *E. exclamationis* is heterogenic in nature. Part of caterpillars go into diapause in August and pupate in spring next year. Another part of caterpillars have continual development and give beginning for second generation which goes under diapause in the last larval stage. In Poland *E. exclamationis* has one or two (incomplete) generations." (65)

Kowalska, T. and K. Szczepanska. 1966. Preliminary investigations on efficiency of new carbamate and organophosphorous insecticides against cutworms. Biul. Poznan. Inst. Ochr Rósl., 34:431-435.
English summary: In laboratory tests for the control of *Agrotis segetum* Schiff., *Agrotis exclamationis* L., and *Amathes c-nigrum* L., the highest mortality was achieved with Folithion 50% EC (100%). Sevin 50S and Sevin 85S gave up to 97.5% control while Lebaycid 50EC gave only 60% control. (435)

Kowalska, T. and K. Szczepanska. 1969. Studies on the control of the Agrotinae (Lepidoptera, Noctuidae, Agrotinae). Pt. I. The susceptibility of larvae of

different instars to chemical preparations of the chlorinated-hydrocarbon group. Prace Nauk. Inst. Ochr. Rósl., 11(2):119-139.
"During the years 1963-64 at the Institute of Plant Protection in Poznan, the investigations were carried out in laboratory conditions upon the effectivity of insecticides of the chlorinated hydrocarbon group applied against the caterpillars of *Agrotinae:Amathes (Rhyacia) c-nigrum* L. and *A. (Euxoa) exclamationis* L. in various developmental stages. The best results were obtained in the control of caterpillars of *A. c-nigrum*, the preparations based upon DDT in the dust formula."

Krasucki, A. 1929. Observations on the pests of cultivated plants in south-eastern Poland in 1929. Mém. Inst. Nat. Polon. Econ. Rur. Pulawy., 10(2):588-595.
Title only. (In Polish.)

Kuwayama, S., K. Kuribayashi, and K. Oshima. 1925. Insects and fungi injurious to the sugar-beet and the preventive methods. Hokkaido Agr. Exp. Sta., Bull. 36: 1-138.
"More than 30 insects are known to be injurious to sugar-beet in Hokkaido. Notes are given on the morphology, life-history, and habits of the more important pests, *viz.*: Collembola, *Smynthurus hortensis*, Fitch; Lepidoptera, *Barathra brassicae*, L., *Agrotis (Rhyacia) c-nigrum*, L., *Euxoa segetum*, Schiff., *Polia illoba*, Butl., *Zinckenia fasciata*, Cram., and *Pyrausta nubilalis*, Hb.; Coleoptera, *Chaetocnema chalceola*, Jac., *Phyllotreta sinuata*, Redt., *Serica salebrosa*, Brenske, *Cassida nebulosa*, L., and *Luperodes nigripennis*, Motsh., var. *discrepans*, Baly; and Rhynchota, *Tuponia guttula*, Mats., *Lygus kalmi*, L., and *Myzus persicae*, Sulz." (RAE 13:548.)

Kuwayama, S. 1926. A list of the insects injurious to agricultural and horticultural plants in Hokkaido. Hokkaido Agr. Exp. Sta., Bull. 42:1-130.
Title only. (In Japanese.)

Kuwayama, S., K. Sakurai, and K. Endo. 1960. Soil insects in Hokkaido, Japan, with special reference to the effects of some chlorinated hydrocarbons. J. Econ. Entomol., 53(6):1015-1018.
"In Hokkaido many species of cutworms are pests of sugar beets, flax, legumes, onion, cabbage, and other crops. *Agrotis ipsilon* Hufn., *A. fucosa* Butt., *A. exclamationis informis* Leech, and *Amathes c-nigrum* (L.) are common and devour crops ravenously on occasion. Former recommendations were the application of poison bait, trapping moths by molasses specially prepared, and regulation of transplanting time of some crops. However, as shown in table 6, chlorinated hydrocarbons will also control cutworms. Mixing heptachlor or aldrin dust with the soil in furrows just before sowing or in holes just before transplanting will prevent attacks." (1017)

Lacroix, D. S. 1924. The occurrence of an important European parasite in North America (Hymen:Elachertidae). Entomol. News, 35(6):217.
"While attempting to follow the life history of the spotted cut-worm (*Agrotis c-nigrum* L.) on the cranberry, the writer encountered several parasitic insects. Specimens of some hymenopterous parasites were sent to Dr. L. O. Howard for identification, and were turned over by him to Mr. A. B. Gahan. Mr. Gahan's final determination brought to light the first record of *Euplectrus bicolor* Swederus (Elachertidae) in this country. Dr. Howard states that this is an important parasite of cutworms in France and Italy, and that no record of its appearance in North America has heretofore been established."

Lacroix, D. S. 1932. Tobacco insects in 1931. Conn. Agr. Exp. Sta., Bull. 335: 261-274.
Three fields were infested by the spotted cutworm and required intensive control measures. These cutworms moved into tobacco fields as the hay fields were cut. (263-264)

Lacroix, D. S. 1935. Insect pests of growing tobacco in Connecticut. Conn. Agr. Exp. Sta., Bull. 379:88-130.
Appearance, habits, distribution, and food plants other than tobacco are given for *Agrotis c-nigrum*. (96-97)

Lempke, B. J. 1965. Moths with red eyes. Entomol. Ber., 25(5):82.
A specimen of *Amathes c-nigrum* was collected on August 27, 1964, at Zwakhals, Netherlands. (Translated from Dutch.)

Li, Fweng-swen and Tsing-chao Ma. 1934. A synposis of cotton insects in China. Yearbook Bur. Entomol. Hangchow, 3:185-187.
"This is a preliminary list consisting of 116 species of the cotton insects known to occur in China. The distribution, host plants, part of the cotton plant attacked, and the destructive stage for each species are also included. Most of the data are recorded for the first time in China." (185)

Lipa, J. J. 1965. Introductory investigations to integration of the pest control of beets. Biul. Inst. Ochr. Rósl., 31:395-407.
"In this review the problem of integration of chemical and biological control measures is discussed and the results of integrated control measures of beet pests from pilot tests are listed. The investigations were concerned with observations of natural enemies of different pests, especially the Silvery moth (*Plusia gamma* L.) and *Agrotis c-nigrum* L. At the same time, in the laboratory conditions, was investigated the efficiency of biopreparations of *Bacillus thuringiensis* against different stages of *Agrotis c-nigrum*....The tests using the bio preparations and their combinations with Azotox liquid 30% showed high efficiency against the different larval stages of *Agrotis c-nigrum* and also different susceptibility of particular stages to different combinations." (407)

Lipa, J. J., T. Kowalska, and K. Szczepanska. 1969. The results of laboratory studies of the susceptibility of *Agrotis c-nigrum* L. (Lepidoptera, Noctuidae) to commercial biopreparations of *Bacillus thuringiensis* Berliner. Biul. Inst. Ochr. Rósl., 45:115-130.
"Effectiveness of the following biopreparations was tested: Biospor, Thuricide 90T, Endobakterin 3. Biopreparations were applied at two concentrations, 1% and 3%, as well as mixtures of those preparations with DDT. Leaves of sugar beets as well as ten larvae kept on each leaf were sprayed with these preparations. Observations were conducted for 10 days. After 48 hrs. the treatments started the mortality of larvae which was low with the exception of L_1 larvae. The mortality of larvae evaluated after 10 days was much higher. The mixtures of biopreparations with DDT did not show the synergistic action on larvae of *A. c-nigrum*. The biopreparations applied at 3% caused higher mortality than when applied at 1%. The results did not show any significant differences in action among the particular biopreparations." (130)

Lipa, J. J. 1970. A cytoplasmic polyhedrosis virus of *Triphaena pronuba* (L.) (Lepidoptera, Noctuidae). Acta Microbiol. Polon. Ser. B, 2(4):237-242.
A polyhedrosis virus of *Triphaena pronuba* (L.) was found to be infectious to *Amathes c-nigrum* L., *Noctua fimbriata* (Schreber), and *Axylia putris* (L.). (239)

Lipa, J. J. 1972. Yeasts isolated from some noctuids and their pathogenicity to *Agrotis* spp. (Noctuidae, Lepidoptera). Acta Microbiol. Polon. Ser. B, 4(2): 89-95.
"Yeasts associated with larvae and adults of *Agrotis exclamationis* L., *A. c-nigrum* L., and *A. segetum* Schiff. have been isolated. Among a number of isolations, six yeast species have been identified. Yeast infections have been frequently observed among larvae and adult moths reared under laboratory conditions as well as among those collected in the field. In spite of very frequent isolations of yeasts, their pathogenicity to larvae has been low." (89)

Lipa, J. J. and E. Wiland. 1972. Bacteria isolated from cutworms and their infectivity to *Agrotis* spp. (Lepidoptera, Noctuidae). Acta Microbiol. Polon. Ser. B. Appl., 4(3):127-140.
"Several bacteria have been isolated from healthy, diseased and dead larvae of four noctuids: *Agrotis c-nigrum* L., *A. exclamationis* L., *A. segetum* Schiff, and *Heliothis armigera* Hbn. The following nine isolated bacteria were identified to species: *Aerobacter cloacae* (Jordan), *Alcaligenes recti* (Ford), *Bacillus thuringiensis* Berliner, *Brevibacterium maris* (Harrison), *Escherichia coli* (Migula), *Escherichia freundii* (Braak), *Micrococcus luteus* (Schroeter), *Speudomonas fluorescens* Migula, and *Serratia marcescens* (Bizio). Bacterial microflora of examined noctuids were relatively uniform and the same bacteria were isolated from various noctuids living in the mixed populations or in similar environment. Tests on pathogenicity showed differences in infectivity of studied species and their strains to tested noctuids. Strains isolated from insects were more infectious than strains isolated from other sources. Larvae of *Agrotis c-nigrum* L. were less susceptible than larvae of *Agrotis segetum* (Schiff)." (127)

Lochhead, W. 1919. Class book of economic entomology with special reference to the economic insects of the northern United States and Canada. P. Blakiston's Son & Co., Philadelphia, 459 pp.
"Spotted Cutworm (*Agrotis c-nigrum* Linn.). General color grey to brownish; a row of triangular black spots along each side of back; a pale line down the middle of back, a conspicuous whitish yellowish stigmatal band, and a pale intermediate line; head and shield yellowish-brown; front feet pale brown and shiny, 1-1/2 inches long. Active in April and May in vegetable gardens (Fig. 124)." (185)

Lutz, F. E. 1948. Field book of insects of the United States and Canada, aiming to answer common questions. G. P. Putnam's Sons, New York. 510 pp.
Cutworms in general are described. *Noctua c-nigrum* is figured. (171, 173)

Magerstein, V. 1917. The occurrence of *Agrotis c-nigrum*. Wien. Landw. Zeitg., 67:116-117.
The spotted cutworm has two generations each year in Germany. Moth flight peaks occur in May and August. The larva and adult are described.

Mariani, M. 1939. Fauna lepidopterorum Siciliae. Mem. Soc. Entomol. Ital., 17(2): 143.
The spotted cutworm is included in this faunal list of Sicilian insects as: "*c-nigrum* L. Pn. Md. VIII-X."

McDaniel, E. 1931. Insect and allied pests of plants grown under glass. Mich. Agr. Exp. Sta., Spec. Bull. 214:79.
"Spotted cutworm, *Noctua c-nigrum* Linn. This is one of the commonest species of the northern United States. The larvae feed on practically everything under

glass, and are especially destructive to violets, ferns and tomatoes. At times, they assume the climbing habit."

McDonald, H. 1948. Cutworms and their control in gardens. Dom. Can. Entomol. Lab., Processed Pub. Ser. 81:1-7.
Economic importance, distribution, host plants, description, type of damage, life history, and methods of control for several cutworms are described. The spotted cutworm, *Graphiphora c-nigrum*, was included in this study.

McDunnough, J. H. 1928. A generic revision of North American agrotid moths. Can. Nat. Mus. Bull. 55:1-78.
The moth of *Graphiphora c-nigrum* L. is described. The male genetalia are described and illustrated. Generic synonyms include *Amathes, Megasema, Lytaea,* and *Segetia*. (54-55)

McDunnough. J. H. 1938. Check list of the Lepidoptera of Canada and the United States of America. Part I. Macrolepidoptera. Mem. S. Calif. Acad. Sci., 1: 1-275.
The spotted cutworm is included in this checklist as: "*Graphiphora* Ochs. 1511 *c-nigrum* Linn." (65)

Metcalf, C. L., W. P. Flint, and R. L. Metcalf. 1962. Destructive and useful insects, their habits and control. McGraw-Hill Book Co., New York. 1087 pp.
The spotted cutworm is illustrated in Figure 9. 10A and described as one of a great many species of cutworms which attack corn. It is also mentioned as a pest of tobacco. (595)

Mickel, C. E. 1932. Armyworms in southern Minnesota. J. Econ. Entomol., 25(6): 1123-1128.
"Outbreaks of the alfalfa webworm (*Loxostege commistalis* Walker), wheat head armyworm (*Neleucania albilinea* Hübner), spotted cutworm (*Agrotis c-nigrum* L.), and the armyworm (*Cirphis unipuncta* Haworth) occurred in southern Minnesota in 1932. It was found that the infestations of the armyworm appeared first in winter rye on peat soil and that later they migrated to other crops. Elimination of winter rye as a crop on peat soil, pasturing winter rye in fall and spring, close observation of rye fields in May and early June to discover armyworms if present, and the use of poison bran mash are suggested as control measures. (1123)

Middleton, M. S. 1913. Cutworms and their control. Proc. Entomol. Soc. Brit. Col., 3:36-37.
This describes control methods for *Noctua c-nigrum* and other cutworms, including poison bait, tanglefoot, banding with cotton batten, chickens, cultivation, and destruction of cover crops.

Morrill, A. W., Jr. 1942. Insect damage to tobacco in the Connecticut River Valley. J. Econ. Entomol., 35(1):60-62.
Damage by the tarnished plant bug and by cutworms (*Graphiphora c-nigrum, Euxoa messoria,* and *Polia legitima*) to tobacco in Connecticut, although severe in a few fields, was of little importance for the area as a whole. Damage by cutworms was lessened by the widespread use of poisoned baits and whenever these baits are not used severe injury almost invariably follows. (61)

Muesebeck, C. F. W. 1920. A revision of the North American species of Ichneumonflies belonging to the genus *Apanteles*. Proc. U. S. Nat. Mus., 58:483-576.

Agrotis c-nigrum acts as a host for *Apanteles xylinus* and *A. yakutatensis*. It is possible that *yakutatensis* is just a geographical form of *xylinus*. (545-546)

Muma, M. H. 1946. Insects injurious to corn in Nebraska. Neb. Agr. Ext. Serv. Circ. 1537:1-20.
A large number of cutworms, including *Agrotis c-nigrum*, injure corn in Nebraska. Corn planted in fields which were weedy the previous season or on newly turned sod was liable to cutworm injury because the natural food had been eliminated and the cutworms concentrated on the corn. (17)

Newcomer, E. J. 1933. Orchard insects of the Pacific Northwest and their control. U. S. Dep. Agr., Circ. 270:1-63.
Several species of cutworms, including the spotted cutworm, are responsible for most of the damage done to fruit trees. The habits and methods of control of climbing cutworms are discussed. The moth and larva of the spotted cutworm are figured. (49-50)

Oldroyd, L. T. 1947. Control and biology of cutworms and other insects of importance in Alaska, with special reference to the Matanuska Valley. Univ. Alaska Agr. Exp. Sta., Progr. Rep. 10:51-56.
"The spotted cutworm is one of the more common species occurring at Matanuska. It seems to be of little economic importance, however, under Alaskan conditions. This species overwinters as a partially grown larva and has usually completed its development and pupated prior to the time most garden or field plantings are open to attack. Overwintering larvae are occasionally brought into greenhouses in soil under which conditions they may cause some damage." (52)

Olson, D. C. and R. W. Rings. 1969. Reponses of spotted cutworm larvae to various intensities and wavelengths of light. Ann. Entomol. Soc. Amer., 62(5):941-944.
"Behavioral studies of the phototactic responses of *Amathes c-nigrum* (L.) (Lepidoptera: Noctuidae) to different wavelengths and intensities of light showed that the first three instars were photopositive. The 4th instar was photopositive at lower intensities and photonegative at higher intensities. Fifth, 6th, and 7th instars proved photonegative. Generally, as the intensity of light increased, the first 3 instars became more photopositive, but the 5th, 6th, and 7th instars became progressively photonegative. Different spectral regions under the same intensity conditions caused slight variations. Sixth instars did not respond positively or negatively to yellow light during 10-min. intervals. Seventh instars did not respond to either yellow or green light in 10-min. intervals. When the time intervals were extended to 30 minutes, 7th instars again responded photonegatively." (941)

Olson, D. C. and R. W. Rings. 1969. Climbing responses of the spotted cutworm, *Amathes c-nigrum*. Ann. Entomol. Soc. Amer., 62(6):1403-1406.
The climbing behavior of each of the 7 instars of *Amathes c-nigrum* (L.) (Lepidoptera: Noctuidae) was noted under varying conditions of light, temperature, and food in the laboratory. At 26° C, with no food in the bottom of the climbing arena, the first 3 instars displayed a tendency to climb under both light and dark conditions. Fourth and 5th instars displayed very little tendency to climb regardless of the conditions. Sixth and 7th instars demonstrated a strong tendency to climb in the dark but remained completely concealed during light conditions. Food in the bottom of the climbing arena reduced the climbing propensity in all experiments. When the temperature was lowered to 20° C, 1st instars displayed a slightly reduced tendency to climb. Practically no climbing took place for 1st, 2nd, and 5th instars when the temperature was dropped to 7° C." (1403)

Palm, C. E. and W. D. Wylie. 1942. Entomology and limnology. Biology and control of cutworms. Cornell Agr. Exp. Sta., Annu. Rep. 54:127-138.
Two to three pounds of sodium fluosilicate to 100 lb. of bran made the most effective cutworm (including *Graphiphora c-nigrum*) bait, followed by sodium arsenite, white arsenic, and Paris green.

Paradis, R. O. 1963. Note sur le vers gris tacheté, *Amathes c-nigrum* (L.) (Lépidoptères: Noctuidae), s'attaquant aux pommes sur le sol dans le Québec. Ann. Soc. Entomol. Que., 8:45-47.
The spotted cutworm, *Amathes c-nigrum* (L.) is described as a pest of apples at Saint Hilaire, Quebec. The geographical distribution, damage, and description of life stages are discussed.

Peterson, A. 1962. Larvae of insects. An introduction to Nearctic species. Part I. Lepidoptera and plant-infesting Hymenoptera. Edwards Brothers, Inc., Ann Arbor, Mich. 315 pp.
"*Amathes c-nigrum* L. is included in a list of common, important or unusual species of Lepidoptera. It is not illustrated or described.

Poitout, S. and R. Bues. 1969. Consanguinity in Noctuid Lepidoptera. Demonstration of its importance in the conducting of rearing under artificial conditions. Ann. Zool. Ecol. Anim., 1(3):245-264.
By ensuring that strict inbreeding (crosses between siblings) could not take place, it was possible during rearing on an artificial medium in the laboratory in France to obtain 14 successive generations of corn earworm (instead of 3), 10 of spotted cutworm (instead of 5), and 28 of beet armyworm (instead of 2). Similar results were obtained with variegated cutworms.

Portchinsky, I. A. 1913. A review of the spread of the chief injurious animals in Russia during 1912. Yearbook Dep. Agr., Central Board Land Admin. and Agr., pp. 351-361.
"*Agrotis c-nigrum*, which has been considered to be little injurious, has done damage in the government of Vjatka, where its caterpillars appeared in the first half of May on winter-sown fields, feeding first on weeds and later on the crops." [RAE 2:197.]

Proeseler, G. 1971. Transmission of the turnip yellow mosaic virus by insects with biting mouthparts. Arch. Pflanzenschutz, 7(6):391-397.
The cabbage looper, *Mamestra brassicae*, was incriminated as a new vector of turnip yellow mosaic virus in Germany. Tests with *Amathes c-nigrum* failed to transmit the virus. (396)

Puttler, B. and S. E. Thewke. 1971. Field and laboratory observations of *Hexamermis arvalis* (Nematoda: Mermithidae), a parasite of cutworms. Ann. Entomol. Soc. Amer., 64(5):1102-1106.
Amathes c-nigrum was one of the most prevalent species of cutworms never parasitized by *Hexamermis arvalis*, although occupying the same ecological niche as three other cutworm species which were parasitized.

Rekach, V. N. 1933. Cutworms as pests of cotton and other crops in Transcaucasia. Trans. Transcauc. Cotton Sci. Res. Inst., (40): 44 pp.
"Notes, partly based on the literature, are given on the bionomics of cutworms that cause considerable injury to cotton in Transcaucasia, the principal species recorded since 1927 being, in order of importance, *Euxoa segetum*, Schiff., *E. temera*, Hb., *f. hubneri*, Bours., *Agrotis (Rhyacia) ypsilon*, Hfn., and *A. (R.) c-nigrum*, L. *Feltia exclamationis*, L., *E. conspicua*, Hb., and *A. flammatra*,

Schiff. were also observed, but only caused slight damage." [RAE 21:576.]

Rings, Roy W. and G. J. Musick. 1976. A pictorial field key to the armyworms and cutworms attacking corn in the north central states. Ohio Agri. Res. and Dev. Ctr., Res. Circ. 221:1-36.
An illustrated key is presented for 12 species of armyworms and cutworms attacking corn in the north central states. The lateral and dorsal views of the spotted cutworm are illustrated as well as the front view of the head and the left mandible. (20-21)

Rings, Roy W. 1977. An illustrated field key to common cutworm, armyworm, and looper moths in the north central states. Ohio Agri. Res. and Dev. Ctr., Res. Circ. 227:1-60.
A key to 29 species of armyworms, cutworms, and looper moths commonly caught in light traps in the north central states is presented. The spotted cutworm is illustrated in Figure 5, while a technical description is given on page 50. The seasonal distribution, larval appearance, host plants, and economic importance are also discussed briefly.

Rings, Roy W. 1977. A pictorial field key to the armyworms and cutworms attacking vegetables in the north central states. Ohio Agri. Res. and Dev. Ctr., Res. Circ. 231:1-36.
An illustrated field key is presented for 11 common species of armyworms and cutworms attacking vegetables in the north central states. The spotted cutworm is illustrated from the lateral and dorsal views. Also shown in line drawings are the left mandible and front view of the head showing its reticulated pattern.

Robinson, R. R. 1974. Insects of peas. Pacific Northwest Coop. Ext. Pub. 150, pp. 1-19.
Description, type of damage, life-history, detection, and control are described for the spotted cutworm (*Amathes c-nigrum*). The larvae are foliar feeders and cause continual damage because of overlapping generations.

Rockburne, E. W. and J. D. Lafontaine. 1976. The cutworm moths of Ontario and Quebec. Research Branch, Canada Dep. Agr., Pub. 1593:1-164.
"This species, commonly called the spotted cutworm, is found throughout both Ontario and Quebec as far north as James Bay. The first brood flies in May, and the second in September. Goosefoot (*Chenopodium* spp.) is the food plant of the larva." The moth is illustrated in color in Fig. 124. (31)

Rockwood, L. P. 1926. Alfalfa and clover insects in the North Pacific region. Col. Port Digest, 4(4):8-9.
A brief account of the principal insect pests of alfalfa and clover in the northwestern U.S., with notes on their biology and control. *Agrotis c-nigrum* was sometimes injurious to field crops.

Sacharov, N. 1916. *Laphygma (Caradrina) exigua,* Hb., and its control. Agr. Herald South East Saratov., (3):5-9.
Agrotis c-nigrum, L. was observed on tomatoes and capsicum. [RAE 4:292.]

Salkeld, E. H. 1973. The chorionic architecture and shell structure of *Amathes c-nigrum* (Lepidoptera: Noctuidae). Can. Entomol., 105(1):1-10.
"The chorionic architecture including the general and fine structure of the various shell layers and specialized areas in the newly laid egg of *Amathes*

c-nigrum L. is described. The chorion is, primarily, two-layered. The lamellate outer layer, comprising the main bulk of the shell, appears to be very porous over the ventral surface of the egg but much more solid over the lateral and upper surfaces. Here it is traversed by aeropylar canals which convey air to the inner layer. The trabecular inner layer completely surrounds the yolk except in the micropylar area. The micropyles protrude from the inner side of the chorion to form entomicropylar tubes which project towards the yolk. Each is enclosed by thickened vitelline membrane." (1)

Sanborn, C. E. 1912. Garden and truck crop insect pests. Okla. Agr. Exp. Sta., Bull. 100:1-76.
"The spotted cutworm is one of our most common and destructive species of this class. It is very cosmopolitan in food habit--in fact, omnivorous; it also has a climbing habit, and sometimes migrates in numbers like the army worms. The larvae feed on a wide variety of crops including beets, cabbage, cauliflower, turnip, pea, carrot, tomato, celery, rhubarb, currant, gooseberry, corn, clover, and ornamental plants. The cutworm is pale brown or gray with greenish or olive tints, the last segment marked with oblique lines." Cutworm remedies are discussed briefly. The moth and larva are figured. (14-15)

Sanborn, C. E. 1916. Garden and truck crop insect pests. Okla. Ext. Circ. 41:14-15.
Noctua c-nigrum Linn. is one of the most common and destructive species of cutworms. A brief account is given of the food habits, description, and remedies. The larva and moth are figured.

Satterthwait, A. F. 1933. Larval instars and feeding of the black cutworm, *Agrotis ypsilon* Rott. J. Agr. Res., 46(6):517-530.
"Crumb (1, p. 134, 138) found a seventh instar in the spotted-sided cutworm, *Agrotis badinodis* Grt., and the spotted cutworm, *Agrotis c-nigrum* L., but made no comment." (528)

Shchegolev, V. N. 1929. Owlet-moths as pests of technical plants in the North Caucasus. Plant Protect., 6 (3-4):399-406. Title only. (In Russian.)

Schoyen, T. H. 1924. Report on insect pests occurring in agriculture and horticulture in 1922 and 1923. Report of the state entomologist. 40 pp.
Agrotis c-nigrum was injurious to strawberries in Norway. [RAE 15:236.]

Schoyen, T. H. 1930. Report on insects injurious to agriculture and horticulture in 1928 and 1929. Report of the state entomologist. 36 pp.
The spotted cutworm is listed as a pest of tomatoes in Norway. (C7)

Severin, H. H. P. and H. C. Severin. 1915. Life history, natural enemies and the poisoned bait spray as a method of control of the imported onion fly (*Phorbia cepetorum* Meade), with notes on other onion pests. J. Econ. Entomol., 8(3): 342-350.
"Cutworms caused a slight amount of injury in the onion growing districts near Racine, Wis., in 1913. The damage to onions by these pests was principally the work of the spotted cutworm (*Noctua c-nigrum* Linn.) and the variegated cutworm (*Peridroma saucia* Hbn.). The spotted cutworm was so heavily parasitized by a parasite, *Apanteles (Protapanteles)* sp., in 1913 that little injury was caused to the onions by the pest." (349)

Shek, G. Kh. 1965. On noctuid pests (Noctuidae, Agrotinae) in Kazakhstan. Zool. Zhur., 44(2):296-299.

Amathes (Graphiphora) c-nigrum was a component of a whole complex of cutworms which were injurious and widely distributed in Kazakhstan. (299)

Singh, M. P. 1962. Environmental factors influencing the development of the cutworms. I. Temperature reactions. Proc. Zool. Soc. (India), 15(1):27-37.
"The influence of some of the environmental factors, mainly temperature, on the development of different stages of three species of cutworm, *viz., Triphaena pronuba* (L.), *Agrotis segetum* Schiff., and *Amathes c-nigrum* (L.), was studied and the relationship has been demonstrated in this paper. The temperature regime employed for this investigation was 10 - 35° C with 5° C intervals." (27)

Singh, M. P. and D. K. M. Kevan. 1956. Notes on three common British species of agrotid moth. I. Longevity and oviposition. Entomol. Rev. J. Var., 68:233-235.
In *Amathes c-nigrum*, egg-laying commences shortly after emergence, the preoviposition period lasting about 3-4 days. The number of eggs per female was a min. of 55, max. of 148, and mean of 95. The ovipositional period was 5-7 days. Longevity for males was 8-10 days and for females 6-7 days. (234)

Smith, J. B. 1893. Catalogue of the lepidopterous superfamily. Noctuidae found in boreal America. Bull. U. S. Nat. Mus., 44:1-424.
"*N. c-nigrum* Linn. 1758. Linn., Syst. Nat., ed. X, 516, *Noctua*. 1767. Linn. Syst. Nat., ed. XII, 852, *Noctua*. 1816. Hbn., Verzeichniss, 223, *Megasema*. 1852. Gn., Sp. Gen. Noct., I, 328, *Noctua*. 1856. Wlk., C. B. Mus., Het., X, 389, *Graphiphora*. 1875. Speyer, Stett, Ent. Zeit., XXXVI, 126, *Agrotis*. 1883. Edw., Papilio, III, 133, *Agrotis*. Habitat.-North America and Europe; New York, June to October; Illinois, August and September. The economic bibliography is large, and the species is frequently referred to in publications in such manner only as not to merit citation here."

Smith, P. W., J. G. Taylor, and J. W. Apple. 1959. A comparison of insect traps equipped with 6- and 15-watt blacklight lamps. J. Econ. Entomol., 52(6):1212-1214.
"In recent years entomologists have made increasing use of self-draining omnidirectional light traps (Taylor *et al.* 1956) equipped with 15-watt blacklight (BL) fluorescent lamps (1950 fluorens). Three years' experience with such a trap in Wisconsin has shown it was satisfactory for collecting many nocturnal species. In 1958 a study was conducted near Arlington, Wis., comparing this trap with a smaller self-draining omnidirectional unit equipped with a 6-watt blacklight lamp (570 fluorens)." (1212) The 6-watt trap, during eight nights of operation, caught 60 spotted cutworm moths compared to 92 moths in the 15-watt BL trap. (1213)

Speare, A. T. 1920. Further studies of *Sorosporella uvella*, a fungous parasite of noctuid larvae. J. Agr. Res., 18(8):399-438.
Several hosts were used, one of them *Noctua c-nigrum*, to test the parasitism of the fungus *Sorosporella uvella* and to determine a method of infection which would be adapted to the inoculation of insects artificially on a large scale.

Speyer, A. 1875. Europäisch - amerikanische verwandtschaften. II. Entomol. Zeit., 36(1-3):97-127.
The author compared the appearance and morphology of spotted cutworm moths from North America and Europe. The species is distributed throughout the northern hemisphere. (Translated from German.)

Stanley, W. W. and S. E. Bennett. 1965. Seasonal abundance of 13 species of moths caught in light traps in Tennessee. J. Tenn. Acad. Sci., 40(4):118-131.

Blacklight traps were operated in seven counties in Tennessee from 1955 to 1958. Spotted cutworm moths were caught from the first week in April to the second week in November. Plate 9 graphs the light trap catches of *Amathes c-nigrum*.

Sulcs, A. and J. Viidalepp. 1969. Verbreitung der Grosschmetterlinge (Macrolepidoptera) in Balticum. Deut. Entomol. Zeit., 16:217-272.
Amathes c-nigrum L. was abundant in Estland and Lettland and common in Litauen, Germany. (218) (Translated from German.)

Symons, T. B. 1905. The common injurious and beneficial insects of Maryland. Md. Agr. Exp. Sta., Bull. 101:125-204.
"This is one of our more common species belonging to the class of cutworms. It has been found injuring a variety of cultivated plants. It does its injury like most cutworms by partly or wholly cutting off the young plants at or about the surface of the soil. The majority of them work at night, which increases the difficulty of controlling them." Cutworm remedies are discussed briefly.

Symons, T. B. 1907. Principal injurious insects of the year. Yearbook U. S. Dep. Agr., 1907:1-798.
"The spotted cutworm (*Noctua c-nigrum* L.) was injurious in Pennsylvania in 1907." (545)

Szczepanska, K. and T. Kowalska. 1969. Studies on the control of the Agrotinae (Lepidoptera, Noctuidae, Agrotinae). Pt. II. The effectiveness of action of organophosphorus and carbamate insecticides against the larvae of Agrotinae. Prace Nauk. Inst. Ochr. Roś1., 11(2):141-150. (In Slavic, English summary.)
"In 1965 at the Institute of Plant Protection in Poznan, laboratory investigations were carried out upon the effectivity of action of few phospho-organic and carbaminated preparations against the larvae of *Amathes c-nigrum, A. exclamationis,* and *A. segetum.* The best toxic action showed the Folithion EC 50 applied in 0.3% concentration. Also, good toxic action against the caterpillars of *A. nigrum* showed the preparation Foschlor R 50. Out of carbaminated preparations tested against *A. c-nigrum,* the best showed to be Sevinon and Dicarbam." (150)

Thygesen, T. 1968. Cutworms. Investigations on biology and results of control tests in 1959-66. Tidsskr. Plavl., 71:429-443.
The spotted cutworm was one of seven species studied to document their biology and control. Experimental insecticides included aldrin, endosulfan, diazinon, parathion, carbaryl, and azinphosmethyl. (In Danish.)

Tietz, H. M. 1951. The lepidoptera of Pennsylvania. A manual. Penn. State College Agr. Exp. Sta. 193 pp.
Distribution, life history, and food plants of the spotted cutworm are described. (55-56)

Tietz, H. M. 1972. An index to the described life histories, early stages, and hosts of the macrolepidoptera of the continental United States and Canada. A. C. Allyn, Sarasota, Fla., 1-2:1-1041.
This publication includes a list of periodicals, journals, bulletins, and memoirs which deal with lepidopterous life histories and host plants. It also contains a list of insect common names and another list of common names of plants upon which lepidopterous insects feed. The species names are listed alphabetically with synonyms, references dealing with life history, and food plants. (196-198)

Treat, A. E. 1955. The response to sound in certain Lepidoptera. Ann. Entomol. Soc. Amer., 48:272-284.
A method is described for the kymographic recording of certain types of overt response to sound, chiefly in noctuid Lepidoptera, including *Graphiphora c-nigrum*. Three types of response were illustrated kymographically: (A) initiation of flight movements; (B) change in form and frequency of the wing beat; (C) interruption or cessation of flight movements.

Treat, A. E. 1956. The reaction time of noctuid moths to ultrasonic stimulation. J. N. Y. Entomol. Soc., 64(1-4):165-171.
Purely ultrasonic stimuli were generated by a piezoelectric crystal plate of Rochelle salt, driven at various frequencies by an oscillator and amplifier. The spotted cutworm and armyworm moths were exposed to this ultrasonic stimulation and their reaction times were measured. Males of *c-nigrum* responded in 151 milliseconds, whereas females responded in 129 milliseconds.

Treat, A. E. and K. D. Roeder. 1959. A nervous element of unknown function in the tympanic organs of moths. J. Ins. Pathol., 3:262-270.
The B neurone is in close anatomical relation with the nerve fibers coming from the scoloparium. No direct interaction with the acoustic elements has been demonstrated, and the function of the cell remains unknown. A B neurone has been found in every noctuid species examined. A histological preparation was made from *Graphiphora c-nigrum*.

Tseng, Sheng. 1943. A comparative study on the morphology of cutworms, Part I, External morphology:41-56. Sine loco. [RAE 34:116.]
Details are given of the external morphology of the larvae of four cutworms known to be injurious in China, including *Amathes (Agrotis c-nigrum)*.

Turner, W. B. 1918. Female lepidoptera at light traps. J. Agr. Res., 14(3):135-149.
An attempt was made to determine the ratio of males to females taken in light traps and to determine the stage of egg development (gravid or spent). Of all the species recorded, only in *Noctua c-nigrum* did the females collected equal or exceed the males.

Turner, W. B. 1920. Lepidoptera at light traps. J. Agr. Res., 18(9):475-481.
During the summer of 1916 extensive observations were made at Hagerstown, Md., to obtain additional information concerning the relative proportion of the sexes of moths taken at light traps. In only two species, *Noctua c-nigrum* and *Euparthenos nubilis*, were the sexes equally represented.

United States Department of Agriculture

Cooperative Economic Insect Report[4]

The Bureau of Entomology of the U. S. Department of Agriculture, in cooperation with the State Entomologists, Entomologists of the Agricultural Experiment Stations, State Departments of Agriculture, Agricultural Colleges, and other entomological agencies, organized an Insect Pest Survey in 1921. This survey attempted to assemble and disseminate all data on the distribution, seasonal and regional fluctuation of insect abundance, weather data as related to insect outbreaks, phenological data, and other miscellaneous information. Each year an annual digest of important facts gathered during the past season was published in the form of Insect Pest Summaries.

[4]Issued by Plant Protection and Quarantine Programs, Animal and Plant Health Inspection Service, U. S. Department of Agriculture.

From 1921 to 1950, this publication was entitled The Insect Pest Survey Bulletin. In 1951, the Bulletin was replaced by the Cooperative Economic Insect Report, Vol. 1, No. 1, July 31, 1951. On Jan. 1, 1976, the name was again changed to the Cooperative Plant Pest Report.

1922. U. S. Dep. Agr. Insect Pest Surv. Bull. 2.
The spotted cutworm (*Agrotis c-nigrum*) in Connecticut: "Adults emerged May 1. Some larvae collected feeding on leaves instead of cutting the stems in New Haven County." (89) Spotted cutworm (*Agrotis c-nigrum*) "on July 19, this insect was found attacking onions in Sunderland district in the Connecticut Valley, (Massachusetts) the larvae cutting the half grown to nearly full grown plants nearly to the bulb. The field infested was directly west of a heavy clover sod which had just been cut. It seems evident that the cutworms migrated from this clover field. In 2 days they had worked into the field 14 rows. In another case where recently cut clover was near by, they had migrated to corn and onions. It was not uncommon to find from two to three well grown larvae in a single onion leaf." (178)

1923. U. S. Dep. Agr. Insect Pest Surv. Bull 3.
"The spotted cutworm has done more injury on the cranberry bogs than in any previous year. We find that this insect is most likely to attack bogs that are bared of their winter flowage very late in May or in early June. It has cleaned up the crop of more than 150 acres of bog here this season, reducing the prospective crop by fully 10,000 barrels" in Massachusetts. (237)

1927. U. S. Dep. Agr. Insect Pest Surv. Bull. 7.
From Massachusetts "Mr. Whitcomb has just sent in a report on the spotted cutworm as follows: Nearly full grown larvae numerous and active. They are now feeding on chickweed clover and shepherd's purse but promise to attack severely any garden plants which are sprouted or transplanted in the next two weeks." (68)

1929. U. S. Dep. Agr. Insect Pest Surv. Bull. 9.
"*Agrotis c-nigrum* L. is moderately abundant on blueberry in Cumberland and Hancock counties, Maine. Cutworms are destructive at Emminence, Kentucky. *Agrotis ypsilon* Rott. occasionally seen, *Agrotis c-nigrum* L. frequently seen. The spotted cutworm was reported from Lincoln, Nebraska, on May 19 as moderately abundant." (109)

1930. U. S. Dep. Agr. Insect Pest. Surv. Bull. 10.
The cutworms *Agrotis c-nigrum* L. and *Neuria procincta* Grote are not so numerous as usual at Forest Grove, Ore., perhaps because of unusually severe cold in January. (85) Five times as many moths of *Agrotis c-nigrum* L. were taken in bait traps in May 1930 as in May 1929.

1931. U. S. Dep. Agr. Insect Pest Surv. Bull. 11.
A recently emerged moth was taken at Ithaca, N. Y., on May 31. (162) Cutworms were pupating from May 15 to 20 at Columbia, Mo. The most abundant species were the variegated, the bronzed, and the spotted cutworm. (163) Of nearly 300 adult moths caught in molasses baits in an apple orchard in Yakima County, the spotted cutworm outnumbered five other species three to one. (164) Professor Whitcomb reported a serious outbreak of climbing cutworms in apple orchards in Essex County, where the spotted cutworm was seriously damaging buds and foliage of apple trees about the middle of May. (246) Spotted cutworms caused considerable damage to young corn in the vicinity of Tuxpan, Vera Cruz, Mexico. This cutworm attacked corn in March in the state of Oaxaca. (640) Three serious infestations

of cutworms, probably *Agrotis c-nigrum*, have developed in the last few days. In each case the cutworms attacked tobacco near fields of timothy which had just been cut. As many as 35 to 50 larvae could be found around one tobacco plant. (381)

1934. U. S. Dep. Agr. Insect Pest Surv. Bull. 14.
Variegated, spotted, black, and dingy cutworms were reported very abundant in Tennessee in May. (96)

1935. U. S. Dep. Agr. Insect Pest Surv. Bull. 15.
The spotted and variegated cutworms were the cutworm species most frequently associated with truck crop and flower garden damage in Minnesota around June 21. (220) An outbreak of the spotted cutworm in southwestern Ontario resulted in the destruction of a large part of the sweetclover seed crop. (327)

1936. U. S. Dep. Agr. Insect Pest Surv. Bull. 16.
Spotted cutworm moths were reported to be very numerous at windows in East Lansing, Mich. (99)

1937. U. S. Dep. Agr. Insect Pest Surv. Bull. 17.
On an island in James River, west of Richmond, Va., on which 100 acres of corn was planted, considerable damage was noted on May 28. The cutworms were thought to be black cutworm with a few spotted and bronzed cutworms. (217)

1938. U. S. Dep. Agr. Insect Pest Surv. Bull. 18.
The cutworms reported to be most destructive in Connecticut in 1938 were dark-sided cutworm and the climbing cutworm, *Agrotis c-nigrum* (L.). (145) The spotted cutworm was reported to be active at Parma, Mich., on May 26. (153) Spotted cutworm moths were coming to baits in great numbers on June 9 at Knutson, Minn. (246) Adults of *A. c-nigrum* were coming to trap lights in Cache County, Utah, on June 8. (247)

1940. U. S. Dep. Agr. Insect Pest Surv. Bull. 20.
Spotted cutworms were numerous in a one-half acre strawberry planting in Suffolk County, N. Y., on May 13. Nearly one-fourth of the plants were defoliated.

1953. Coop. Econ. Insect Rep. 3.
A cutworm survey revealed that the heaviest concentrations of cutworms were found feeding on flax in the south central and southwestern parts of Minnesota. The dark-sided cutworm was the most numerous species and other species included the striped, dingy, and spotted cutworms.

1954. Coop. Econ. Insect Rep. 4.
The spotted cutworm caused severe damage to young citrus fruit in some Riverside County, Calif., orchards. The cutworm populations were light to heavy in San Bernardino citrus. (458)

1955. Coop. Econ. Insect Rep. 5.
The spotted cutworm was responsible for clipping runners of strawberry plants in the Cumberland Plateau area of Tennessee. (889)

1956. Coop. Econ. Insect Rep. 6.
Heavy populations of the spotted cutworm occurred on corn in the southeast district of Minnesota. (253)

1959. Coop. Econ. Insect Rep. 9.
Spotted cutworms were prevalent under debris in a clover field in Sussex County, Del. (214) Mature larvae of the spotted, dingy, and bristly cutworms were common in alfalfa and clover fields in Kent and Sussex counties, Del. (232) A spotted cutworm adult was taken in a light trap at Gainesville, Fla., on May 13, 1958. This was the first recorded occurrence of the species in Florida. (329) The spotted cutworms caused heavy damage to small acreage strawberry plantings in southwest Sussex County, Del. (334)

1960. Coop. Econ. Insect Rep. 10.
Spotted cutworm larvae were prevalent on clover and alfalfa during late March in Kent and Sussex counties, Del. (257) The spotted cutworm was identified for the first time as having been the cause of damage in some orchards, mainly to the buds of small trees. (1082)

1961. Coop. Econ. Insect Rep. 11.
Corrective control measures were required to reduce populations of the spotted cutworm on beets in Walworth County, Wis. (780)

1962. Coop. Econ. Insect Rep. 12.
Adults of the spotted cutworm were noted in New Castle County, Del. (550)

1963. Coop. Econ. Insect Rep. 13.
Light trap records at Wooster, Ohio, (May 31 - June 6) indicate a considerable increase compared with preceding week. (660) The spotted cutworm caused severe damage to peach orchards in Empire-Modesto areas of California. The larvae chewed large holes in green peaches and severely damaged the foliage. Spotted cutworm moths were abundant in light traps. (711) Cutworms attacking pear leaves in Jackson County, Ore., were reared and determined to be *Amathes c-nigrum*. (1110) The spotted cutworm, which has not been a tobacco pest in recent years, caused some damage to tobacco in Ontario, Canada. (1401)

1964. Coop. Econ. Insect Rep. 14.
The spotted cutworm caused considerable damage to foliage on the interior of pear trees during June in Jackson County, Ore. (185) Moths of the spotted cutworm outnumbered all other cutworm species in New Hampshire blacklight collections. (391) Spotted cutworms were reported to be feeding on Bartlett pear tree sucker leaves in Jackson County, Ore. (646) Populations of spotted cutworms reported to be heavy on violets in Hughson, Stanislaus County, Calif., and pale tussock moths (*Halisidota tessellaris*) predominated in blacklight collections in Washington County, R. I.

1965. Coop. Econ. Insect Rep. 15.
First adult of the season trapped at Wooster, Ohio, on May 10, 1965; eggs deposited May 13. (503) Six moths of the spotted cutworm were taken in blacklight traps in Franklin and Logan counties, Ohio, on May 24 and 25, respectively. (568) A light trap in Columbus, Ohio, yielded four spotted cutworm moths on May 31. (600)

1966. Coop. Econ. Insect Rep. 16.
Spotted cutworm larvae active on alfalfa Feb. 11, 1966, at Carpenter, Ohio; nearly full grown on March 21. (275) Three-quarters grown larvae, probably *Amathes c-nigrum*, abundant in alfalfa of 1965 seeding in Franklin Co., Mass. (482) Late instars of *Agrotis ipsilon* and *Amathes c-nigrum* cut most new shoots

near ground in a Livingston Co., Mich. clean cultivated raspberry planting. (1966) Larvae of *Agrotis ipsilon* and *Amathes c-nigrum* damaged potato tubers in Monroe, Co., Mich., field. (781)

1967. Coop. Econ. Insect Rep. 17.
Spotted cutworm caused only minor feeding damage to alfalfa in Ohio. (161)

1968. Coop. Econ. Insect Rep. 18.
Amathes c-nigrum flight very heavy in New Jersey on June 9, 1968. (552) Flights of black and spotted cutworm moths nearing end at Sodus, Mich., June 17, 1968. (587) Spotted cutworms most numerous of cutworms in Michigan in 1968 as of July 1. (636) Adults continue above normal in all blacklight traps. Counts for the period July 15 by county: Lenawee 34, Berrian 28, Montcalm 39, and Newaygo 26. (701) Black, spotted, and variegated cutworm moths increased slowly but steadily at all blacklight stations in Michigan on Sept. 3. (884) Black, spotted, and variegated cutworm moth counts remained normal during period at all blacklight stations. (901) Noctuid moths abnormally high in Montcalm Co., Mich., during past week; collected 174 *Amathes c-nigrum*. Larvae could be a serious problem next spring. (982) Lenawee Co., Mich., blacklight traps caught 19 *Amathes c-nigrum* moths Oct. 10-16. (1035) Blacklight traps in Lenawee Co., Mich., caught five *Amathes c-nigrum* moths from Oct. 17 to 23, 1968. (1048)

1969. Coop. Econ. Insect Rep. 19.
Ohio 1969 light trap records indicate first generation moths may be higher than since 1965. Records for first 10 days in June show populations three times higher than in either 1967 or 1968. Fewer moths caught in same period in 1969 as in 1966. However, higher numbers indicated June 11-20; in other years numbers dropped during this period. About half of female moths gravid. (452)

1970. Coop. Econ. Insect Rep. 20.
Spotted cutworm moth catches were below the previous 2-year averages in the field and blacklight trap catches in Michigan. (1970) Four hundred and ten spotted cutworm moths were collected in one blacklight trap near Auburn, Schuylkill Co., Pa. (400)

1971. Coop. Econ. Insect Rep. 21
Blacklight trap collections were steadily increasing at all stations in Michigan. This increase could indicate serious trouble in 1972 spring plantings. (528)

1972. Coop. Econ. Insect Rep. 22.
Spotted cutworms caused 33% damage to 30 acres of young Red and Golden Delicious apple trees near Buena, Yakima Co., Wash., and up to 50% damage to 15 acres of Ryan Red Delicious and Golden Delicious trees at Zillah. (242) Cutworms, mainly spotted cutworms, infested 8 acres of pears, caused 5-10% damage, and infested 2 acres of 3-4 year old apples with 15-25% damage at Selah, Yakima Co., Wash. (253) Armyworm and cutworm larvae averaged two per sweep in alfalfa seed field north of Pasco, Franklin Co. Wash.; much damage in weedy portion of field. Bertha armyworm, spotted cutworm, western yellow-striped armyworm, and unspecified species predominate. Spotted cutworm and several other species damaged seed alfalfa near White Swan, Yakima Co., Wash. (477) Unidentified species reported on seed alfalfa north of Pasco (p. 477) determined as *Amathes c-nigrum*. (557)

1973. Coop. Econ. Insect Rep. 23.
Light larval populations of spotted cutworm caused minor damage to 10 acres of

spearmint at Prosser, Wash. (226) Mature larvae of spotted cutworm caused 5% damage on apple nursery stock in green tip stage at Gleed, Wash. (226) Jefferson County blacklight trap catches totaled 100 and 87 spotted cutworm moths, respectively, at Culver and Metolius August 9-16. (600)

1974. Coop. Econ. Insect Rep. 24.
Larvae reported light in an alfalfa field at George, Grant County, Wash., on March 21, 1974. (199) Populations light with minor damage to peppermint near Notus, Canyon Co., Idaho. (247)

1975. Coop. Econ. Insect Rep. 25.
Variegated cutworm larvae and light populations of yellow-striped armyworm, black cutworm, and spotted cutworm defoliated or severely damaged 200 of 500 acres of potatoes in St. Joseph County, Ind. This acreage has received weekly treatments. Shallow tubers were damaged by larvae which ranged up to 25 per square foot. (219)

Van Duzee, E. P. 1885. Correspondence. Can. Entomol., 17(4):80.
Some moths of *Agrotis c-nigrum* were found on choke cherry bushes.

Walden, B. H. 1923. Cutworms injuring strawberries. Conn. Agr. Exp. Sta., Bull. 247:1-381.
Spotted cutworms were found damaging strawberries near New Haven, Conn.

Walkden, H. H. 1950. Cutworms, armyworms, and related species attacking cereal and forage crops in the Central Great Plains. U. S. Dep. Agr., Circ. 849:1-52.
Distribution, economic status, food plants, seasonal history, and natural enemies of the spotted cutworm are discussed. (36-37)

Walker, F. 1856. List of the specimens of lepidopterous insects in the collection of the British Museum. Part X. Noctuidae:389-390.
Graphiphora c-nigrum is described in Latin. Synonyms given are *Bombyx nun-atrum, Noctua gothica,* and *Megasema c-nigrum*.

Waters, H. A. 1943. Rearing insects that attack plants. Amer. Assoc. Adv. Sci., Pub. 20:3-28.
Instructions are given for rearing *Amathes c-nigrum* from egg to adult. (15-16)

Weigel, C. A. and E. R. Sasser. 1923. Insects injurious to ornamental greenhouse plants. U. S. Dep. Agr., Farm. Bull. 1362:1-81.
"Cutworms. Two species of cutworms have been found attacking ferns: the spotted cutworm (fig. 41), and the variegated cutworm (fig. 21). Control. Use poisoned bran mash, poisoned green bait, trap lights, fumigation, and spraying as recommended under control of cutworms on carnations." The moth of the spotted cutworm is figured. (43)

Weigel, C. A. and W. Middleton. 1926. Insect enemies of the flower garden. U. S. Dep. Agr., Farm. Bull. 1495:1-54.
Types of damage and methods of control for the spotted cutworm are described. (19-21)

Weigel, C. A. and L. G. Baumhofer. 1948. Handbook on insect enemies of flowers and shrubs. U. S. Dep. Agr., Misc. Pub. 626:1-115.
Appearance, food plants, type of injury, and control methods of insect pests are described briefly. *Amathes c-nigrum* is one of the common species of cutworms attacking ornamentals.

Whelan, D. E. 1926. Cutworms. Mark. Grow. J. 38-85.
There are many different kinds of cutworms named from their appearance or because of their habits. Some of them are the variegated cutworm, glassy cutworm, greasy cutworm, spotted cutworm, etc.

Whelan, D. B. 1935. A key to the Nebraska cutworms and armyworms that attack corn. Neb. Agr. Exp. Sta., Res. Bull. 81:1-27.
In addition to the key, a larval description, distribution, seasonal abundance, habits, and food plants of the spotted cutworm are given. (20)

White, E. B. 1948. *Amathes c-nigrum*, Linn., pairing with *A. xanthographa*, Fabr. Entomol. Rec. and J. Var., 60:117.
A male *Amathes xanthographa* Fabr. was observed copulating with a female *Amathes c-nigrum* Linn. They remained *in copulo* for 4 days. This was reported from Braunton, N. Devon, Great Britain.

Winters, N. E. 1925. Manual para el cultivo del algodonero en la Republico Argentina. Argent. Minist. Agr., Circ. 539:78 pp.
Agrotis c-nigrum was a pest of cotton in Argentina. [RAE 14:86.]

Wylie, W. D. and C. E. Palm. 1940. A method for production of cutworms in greenhouses. J. Econ. Entomol., 33(3):462-463.
Methods are described for the rearing of cutworms in the greenhouse. Rape, turnips, or sweet clover beds served as the rearing media. In emergencies, lettuce trimmings from a grocery store were used as food. The spotted cutworm was reared by this method and it was not noticeably cannibalistic.

Zacher, F. 1917. Notes on pests of tropical cultivated plants. No. 10. African tobacco pests. Tropenpflanzer Berlin, 20 (4-6):159-175, 207-222, 259-265.
Agrotis c-nigrum was a pest of tobacco in Egypt. [RAE 8:424.]

Zvierezomb-Zubovisky, E. 1918. Brief report on the work of the Don Bureau for the control of pests of agricultural plants for 1917, and review of the pests of agriculture in the Don Province. Rostoff. 36 pp.
Agrotis c-nigrum was a pest of beets in Russia. [RAE 8:105.]

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CHEMICAL-CONTROL SEVINON* SZCZEPANSKA. 18512 1969
CHEMICAL-CONTROL* THYGESEN. BIOLOGY DEN 18612 1968
CHEMICAL-CONTROL* KOWALSKA. POLAND CHEM 11712 1969
CHEMICAL-CONTROL DIAZINON* GASSER. CHEM 08712 1953
CHEMICAL-CONTROL* IONESCU. ROMANIA CHEM 10612 1961
CHEMICAL-CONTROL POLAND* KOWALSKA. ORGA 11612 1966
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CHERRY PEACH* CIPR. BRITISH-COLUMBIA AP 03512 1961
CHERRY PEACH* CIPR. BRITISH-COLUMBIA AP 03412 1960
CHICKWEED CLOVER SHEPARDS-PURSE* IPS. M 19712 1927
CHINA MORPHOLOGY-EXTERNAL* TSENG. CHINA 19212 1943
CHINA SYNONYMS* BOURSIN. CHINA SYNONYMS 01112 1963
CHINA* LI. COTTON CHINA* LI. COTTON CH 12612 1934
CHITTENDEN. VEGETABLES LARVAL-DESCRIPTIO 04412 1907
CHITTENDEN. SUGAR-BEET HOST-RANGE* CHIT 04312 1903
CHLORINATED-HYDROCARBONS JAPAN CABBAGE O 12112 1960
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CIPR. APPLES QUEBEC* CIPR. APPLES QUEBE 03012 1954
CIPR. APPLES BLUEBERRIES QUEBEC* CIPR. 02912 1953
CIPR. APPLES QUEBEC* CIPR. APPLES QUEBE 03812 1964
CIPR. BEETS PEAS NOVA-SCOTIA* CIPR. BEE 02712 1951
CIPR. BRITISH-COLUMBIA APPLE CHERRY PEAC 03512 1961
CIPR. BRITISH-COLUMBIA APPLE CHERRY PEAC 03412 1960
CIPR. CELERY ONTARIO* CIPR. CELERY ONTA 02212 1934
CIPR. MASSACHUSETS CRANBERRY* CIPR. MAS 02112 1923
CIPR. NOVA-SCOTIA POPULATION-LEVEL* CIP 02812 1952
CIPR. ONIONS CARROTS TOMATOES CUCUMBERS 03912 1972
CIPR. ONIONS QUEBEC* CIPR. ONIONS QUEBE 04012 1973
CIPR. ONTARIO CORN BEANS ALFALFA* CIPR. 02412 1966
CIPR. ONTARIO TOBACCO* CIPR. ONTARIO TO 03312 1959
CIPR. ONTARIO ARMYWORMS* CIPR. ONTARIO 03212 1958
CIPR. ONTARIO TOBACCO-GREENHOUSE* CIPR. 02512 1948
CIPR. ONTARIO ARMYWORM* CIPR. ONTARIO A 03112 1957
CIPR. ONTARIO BIRDSFOOT-TREFOIL* CIPR. 03712 1963
CIPR. ONTARIO QUEBEC OATS RHUBARB RED-CL 03612 1962
CIPR. ONTARIO TOBACCO* CIPR. ONTARIO TO 02612 1949
CIPR. SUGAR-BEETS SWEET-CLOVER ONTARIO O 02312 1935
CITRUS* CEIR. CALIFORNIA CITRUS* CEIR. 20812 1954
CLIMBING-BEHAVIOR* OLSON. CLIMBING-RESP 14912 1969
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COOK. LARVAL-KEY LARVAL-DESCRIPTION* CO 04512 1920
COOK. MINNESOTA LARVAL-KEY* COOK. MINNE 04712 1934
COOK. MINNESOTA SEASONAL-DISTRIBUTION* 04612 1921
CORN BEANS ALFALFA* CIPR. ONTARIO CORN 02412 1936
CORN ILLINOIS* FORBES. CORN ILLINOIS* 07212 1904
CORN ILLUSTRATION* METCALF. TOBACCO COR 14012 1962
CORN LARVAL-KEY HOST-RANGE* WHELAN. NEB 23512 1935
CORN LARVAL-KEY LARVAL-ILLUSTRATION* RI 15912 1976
CORN MEXICO TOBACCO* IPS. NEW-YORK MISS 20012 1931
CORN MINNESOTA* CEIR. CORN MINNESOTA* 21012 1956
CORN NEBRASKA* MUMA. CORN NEBRASKA* MU 14512 1946
CORN* FORBES. ILLINOIS CORN* FORBES. I 07312 1905
CORN* IPS. VIRGINIA CORN* IPS. VIRGINI 20412 1937
COTTON CHINA* LI. COTTON CHINA* LI. CO 12612 1934
COTTON RUSSIA* REKACH. COTTON RUSSIA* 15812 1933
COTTON* WINTERS. ARGENTINA COTTON* WIN 23712 1925
CRANBERRY MASSACHUSETTS* FRANKLIN. CRAN 07712 1924
CRANBERRY MASSACHUSETTS CONTROL-MEASURES 08012 1948
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CRANBERRY MASSACUSETTS* IPS. CRANBERRY 19612 1923
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CRANBERRY* CIPR. MASSACHUSETS CRANBERRY 02112 1923
CROSBY. HOST-RANGE LARVAL-DESCRIPTION* 04812 1918
CRUMB. CLIMBING-CUTWORMS GEOGRAPHICAL-DI 05312 1932
CRUMB. EGG-KEY LARVAL-KEY LIFE-HISTORY H 05212 1929
CRUMB. HOST-RANGE LARVAL-DESCRIPTION* C 05112 1927
CRUMB. LARVAL-KEYS LARVAL-DESCRIPTION GE 05412 1956
CRUMB. SEASONAL-DISTRIBUTION LARVAL-DESC 05012 1926
CRUMB. TOBACCO LARVAL-KEY* CRUMB. TOBAC 04912 1915
CUCUMBERS QUEBEC* CIPR. ONIONS CARROTS 03912 1972
CURRANT* DAVIS. CELERY MICHIGAN CABBAGE 05812 1893
CUTWORM-COMPLEX* SHEK. RUSSIA CUTWORM-C 17412 1965
CUTWORM-MOTHS ONTARIO QUEBEC FAUNAL-LIST 16312 1976
DAELE. FRANCE MERCURY-VAPOR-LIGHT-TRAP* 05612 1969
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LARVAL-KEY LARVAL-ILLUSTRATION* RINGS, 15912 1976
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LARVAL-KEY* COOK, MINNESOTA LARVAL-KEY* 04712 1934
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LARVAL-MIGRATION* IPS, CONNECTICUT ONIO 19512 1922
LARVAL-PARASITE PARASITIC-FUNGUS* SPEAR 17912 1920
LEMPKE, NETHERLANDS GEOGRAPHICAL-DISTRIB 12512 1965
LEPIDOPTERA* GROTE, CHECKLIST NORTH-AME 09712 1882
LI, COTTON CHINA* LI, COTTON CHINA* LI 12612 1934
LIFE-CYCLE MOTH-DESCRIPTION* HART, ILLI 09912 1903
LIFE-HISTORY HOST-RANGE ECONOMIC-IMPORTA 05212 1929
LIFE-HISTORY* KOWALSKA, POLAND LIFE-HIS 11512 1962
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LIFE-HISTORY* GIBSON, CANADA LIFE-HISTO 08912 1915
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LIGHT-RESPONSE* OLSON, LARVAL-BEHAVIOR 14812 1969
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LIGHT-TRAPS MARYLAND SEX-RATIO* TURNER, 19412 1920
LIGHT-TRAP SEASONAL-DISTRIBUTION HOST-RA 06012 1937
LIGHT-TRAPS* CEIR, MICHIGAN LIGHT-TRAPS 22312 1971
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LIGHT-TRAPS* CEIR, NEW-JERSEY MICHIGAN 22012 1968
LIGHT-TRAPS FAUNAL-LIST* GAGNEPAIN, FRA 08612 1973
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LIGHT-TRAPS* CEIR, WASHINGTON APPLE LIG 22412 1973
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LIPA, BACTERIA PAHTOGENS POLAND* LIPA, 13112 1972
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LIPA, POLAND BACILLUS-THURINGIENSIS* LI 12812 1969
LIPA, POLYHEDROSIS-VIRUS VIRUSES* LIPA, 12912 1970
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LOCHHEAD, LARVAL-DESCRIPTION* LOCHHEAD, 13212 1919
LONGEVITY OVIPOSITION GREAT-BRITAIN* SI 17612 1956
LUTZ, FIELD-BOOK MOTH-ILLUSTRATION* LUT 13312 1948
MACROLEPIDOPTERA* MCDUNNOUGH, CHECK-LIS 13912 1938
MADAGASCAR* BRENIERE, TOBACCO MADAGASCA 01312 1959
MAGERSTEIN, GERMANY SEASONAL-DISTRUBUTIO 13412 1917
MAINE GEOGRAPHICAL-DISTRIBUTION* BROWER 01512 1974
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MARIANI, SICILY FAUNAL-LIST* MARIANI, S 13512 1939
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MARYLAND SEX-RATIO* TURNER, LIGHT-TRAPS 19412 1920
MASS-REARING AGOTIS-EXCLAMATIONIS* KOWA 11412 1962
MASSACHUSETTS* FRANKLIN, CRANBERRY MASS 07812 1925
MASSACHUSETS CHICKWEED CLOVER SHEPARDS-P 19712 1927
MASSACHUSETTS* FRANKLIN, CRANBERRY MASS 07712 1924
MASSACHUSETTS OUTBREAK* FRANKLIN, CRANB 07912 1928
MASSACHUSETS CRANBERRY* CIPR, MASSACHUS 02112 1923
MASSACHUSETTS CONTROL-MEASURES* FRANKLI 08012 1948
MASSACUSETTS* IPS, CRANBERRY MASSACUSET 19612 1923
MATING-BEHAVIOR SEX-ATTRACTANT* FUJIMUR 08512 1976

OUTBREAK CORN MEXICO TOBACCO* IPS, NEW- 20012 1931
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OVIPOSITION GREAT-BRITAIN* SINGH, LONGE 17612 1956
PAHTOGENS POLAND* LIPA, BACTERIA PAHTOG 13112 1972
PALM, POISONED-BAITS NEW-YORK* PALM, PO 15012 1942
PARADIS, APPLES QUEBEC* PARADIS, APPLES 15112 1963
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PARASITES LARVAL-PARASITE PARASITIC-FUNG 17912 1920
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PATHOLOGY POLAND* LIPA, YEAST-INFECTION 13012 1972
PEACH OREGON PEAR ONTARIO TOBACCO* CEIR 21512 1963
PEACH* CIPR, BRITISH-COLUMBIA APPLE CHE 03512 1961
PEACH* CIPR, BRITISH-COLUMBIA APPLE CHE 03412 1960
PEAR NEW-HAMPSHIRE CALIFORNIA VIOLETS RH 21612 1964
PEAR ONTARIO TOBACCO* CEIR, CALIFORNIA 21512 1963
PEARS ALFALFA* CEIR, APPLES WASHINGTON 22412 1972
PEAS LARVAL-DAMAGE* ROBINSON, PEAS LARV 16212 1974
PEAS NOVA-SCOTIA* CIPR, BEETS PEAS NOVA 02712 1951
PENNSYLVANIA CLIMBING-CUTWORMS LARVAL-DE 08412 1955
PENNSYLVANIA HOST-RANGE SYNONOMY GEOGRAP 18712 1951
PENNSYLVANIA ECONOMIC-IMPORTANCE* SYMON 18412 1907
PENNSYLVANIA LIGHT-TRAPS* CEIR, MICHIGA 22212 1970
PEPPERMINT* CEIR, ALFALFA WASHINGTON ID 22512 1974
PETERSON, ECONOMIC-IMPORTANCE* PETERSON 15312 1962
PHOTOPERIODISM DIAPAUSE* BECK, PHOTOPER 00612 1968
PHOTOPERIODISM* DANILEVSKII, SEASONAL-D 05712 1961
POISONED-BAITS* WEIGEL, GREENHOUSE-PLAN 23112 1923
POISONED-BAITS* MORRILL, TOBACCO CONNEC 14312 1942
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POLAND BACILLUS-THURINGIENSIS* LIPA, BE 12712 1965
POLAND CHEMICAL-CONTROL* KOWALSKA, POLA 11712 1969
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POPULATION-LEVEL* CIPR, NOVA-SCOTIA POP 02812 1952
POPULATION-PREDICTION* DRUZHELIUBOVA, F 06412 1973
POPULATION-SAMPLING BLACKLIGHT-TRAPS WIS 17812 1959
PORTCHINSKY, RUSSIA ECONOMIC-IMPORTANCE* 15512 1913
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POTATOES CHEMICAL-CONTROL SOIL-INSECTICI 10312 1967
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PROESELER, GERMANY TURNIP* PROESELER, G 15612 1971
PUPAL-DESCRIPTION* EDWARDS, LARVAL-DESC 06512 1889

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TOBACCO CONNECTICUT* LACROIX. TOBACCO C 12312 1932
TOBACCO CONNECTICUT* LACROIX. TOBACCO C 12412 1935
TOBACCO CONNECTICUT POISONED-BAITS* MOR 14312 1942
TOBACCO EGYPT* ZACHER. TOBACCO EGYPT* 23912 1917
TOBACCO LARVAL-DESCRIPTION* CHAMBERLIN. 04212 1957
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TOBACCO MADAGASCAR* BRENIERE. TOBACCO M 01312 1959
TOBACCO* IPS. NEW-YORK MISSOURI OUTBREA 20012 1931
TOBACCO* CRUMB. SEASONAL-DISTRIBUTION L 05012 1926
TOBACCO* CIPR. ONTARIO TOBACCO* CIPR. 02612 1949
TOBACCO* CRUMB. EGG-KEY LARVAL-KEY LIFE 05212 1929
TOBACCO* CEIR. CALIFORNIA PEACH OREGON 21512 1963
TOBACCO* CIPR. ONTARIO TOBACCO* CIPR. 03312 1959
TOBACCO-GREENHOUSE* CIPR. ONTARIO TOBAC 02512 1948
TOMATOES CAPSICUM* SACHAROV. RUSSIA TOM 16512 1916
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TOMATOES NORWAY* SCHOYEN. TOMATOES NORW 17212 1960
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TREAT. SOUND-RESPONSE KYMOGRAPHIC-RECORD 18912 1955
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TSENG. CHINA MORPHOLOGY-EXTERNAL* TSENG 19212 1943
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TURNER. LIGHT-TRAPS MARYLAND SEX-RATIO* 19412 1920
TURNIP* PROESELER. GERMANY TURNIP* PRO 15612 1971
TYMPANIC-ORGANS B-NEURONE* TREAT. TYMPA 19112 1959
UKRAINE RUSSIA* KLYUCHKO. UKRAINE RUSSI 11212 1971
ULTRASONIC-STIMULATION NEW-YORK SOUND-RE 19012 1956
UTAH* IPS. CONNECTICUT MICHIGAN MINNESO 20512 1938
VAN-DUZEE. CHOKE-CHERRY CANADA* VAN-DUZ 22712 1885
VEGETABLE ILLINOIS LARVAL-DESCRIPTION* 08312 1878
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VEGETABLES LARVAL-DESCRIPTION* CHITTEND 04412 1907
VER-GRIS-TACHETE COMMON-NAME* BENOIT. V 00812 1975
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VINE-PESTS RUSSIA* FEDOROV. VINE-PESTS 06712 1928
VIOLETS RHODE-ISLAND* CEIR. OREGON PEAR 21612 1964
VIRGINIA CORN* IPS. VIRGINIA CORN* IPS 20412 1937
VIRGINIA* HOFMASTER. POTATOES CHEMICAL- 10312 1967
VIRUSES* LIPA. POLYHEDROSIS-VIRUS VIRUS 12912 1970
WALDEN. STRAWBERRIES CONNECTICUT* WALDE 22712 1923
WALKDEN. CEREAL FORAGE-CROPS HOST-RANGE 22812 1950
WALKER. MUSEUM-LIST SYNONOMY* WALKER. M 22912 1856
WASHINGTON APPLE LIGHT-TRAPS* CEIR. WAS 22412 1973
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WATERS. REARING-INSECTS REARING-MASS* W 23012 1943
WEIGEL. FLOWER-GARDEN CONTROL-MEASURES* 23212 1926
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WHELAN. ORNAMENTALS* WHELAN. ORNAMENTAL 23412 1926
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WINTERS. ARGENTINA COTTON* WINTERS. ARG 23712 1925
WISCONSIN TRAPPING* SMITH. POPULATION-S 17812 1959
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WYLIE. REARING-MASS REARING-GREENHOUSE* 23812 1940
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ZACHER. TOBACCO EGYPT* ZACHER. TOBACCO 23912 1917
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